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The Editor's notes are marked (*Ed.*).

FIRST PART.
ORIGINAL ARTICLES

Industrial Retting of Textile Plants by Microbiological Action

by

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The search for a *retting method based on bacterial action* is due largely to the defects existing in the methods commonly used in rural districts, and also to the deficiencies in the chemical methods by which it was sought to replace them.

The many chemical methods (all reducible no doubt to a single type and aiming solely at dissolution of the interfibrous substances by means of a reagent, the excess of which is afterwards neutralised and disposed of without injury to the fibres themselves) are by the very conditions of the problem incapable of yielding very satisfactory or constant results, for two main reasons, one based on the anatomical nature of the textile fibres, and the other on their chemical composition.

The anatomical impediment lies in the fact that all the stalks the fibres of which are to be separated are not of quite the same age, and the fibres are consequently not of the same thickness.

Therefore the quantity of intercellular matter to be dissolved likewise cannot be the same in every respect.

Hence, there may be an excess or deficiency of reagent, but this would not matter, as the easiest course, that of an excess of reagent, might likewise be adopted. This method might be adequate if the impracticability of devising a specific reagent for the intercellular substances, *i. e.* one which would attack the pectic materials exclusively without occasioning any injury whatever to the cellulose of the fibres, did not render the successful application of chemical methods impossible.

From the basis of our knowledge of the macrochemistry and microchemistry of the intercellular substances it appears impossible to devise

this specific reagent. It may be contended that in view of the affinity between pectic substances and carbohydrates any reagent attacking the former strongly must necessarily attack the latter, at any rate slightly. If in order to surmount this difficulty an insufficient quantity of reagent were employed, the resulting separation of the fibres might be insufficient. That is why all chemical means tend to break up the fibre. A similar defect is obviously inherent in ordinary microbiological methods, i. e. those practised in rural districts for retting purposes.

In these latter it is not only the bacteria of pectic fermentation which multiply, but also other bacteria, chiefly those of cellulose fermentation. This happens so easily that there is the risk of the fibres being injured in the same way as by the action of a chemical reagent common to the two substances.

If it so happens that specific pectic bacterial ferments develop exclusively, or predominate over the others for some length of time, it may be assumed that microbiological retting will take place without any drawbacks; but in this case only. Moreover, it is still necessary to stop the retting process by taking the textile materials out of the liquids in which they are steeped when the necessary limit has been reached. This is not always easy, as it is by no means rare for a lot of hemp or flax to be classified as "over-retted", depreciating markedly in consequence; the most able peasants may make mistakes in this respect. This being the case, nothing but a ferment, fixed or soluble, specific to the pectic substances, acting in pure culture if it is an organism and alone if it is an enzyme, would overcome all the difficulties, because the degree of sensitiveness required for this very special problem can only be obtained from a biological action.

With the help of other workers I showed that there are micro-organisms which attack plant tissues but leave the cells and their derivatives intact. Thus, on preparing a culture of *Bacillus Comesii* in the presence of a leaf of *Medicago lupulina* or *Coronilla Emerus* (sterilised by means of special methods leaving the leaf chemically intact), these leaves are decomposed into 3 parts:

- (a) the parenchyma cells which fall to the bottom of the medium;
- (b) the sclerenchyma, which remains intact in skeleton form;
- (c) the epidermis, which floats on the liquid.

This decomposition goes no farther. By preparing a culture of the same bacillus in the presence of wisps of hemp, under the same conditions as the leaves, the dissociation of the stalk into its three parts is secured wood, textile bast-fibres and cells of the cortical layers. All these parts however, and what is more important, the fibres, may be kept in the presence of the still living bacteria for as long as 2 years without being attacked and even without the breaking-up of the primary fibre. The cellulose wall thus cannot serve as food material for these bacteria.

All these facts (utilised in the method of retting bearing my name) constitute the *pectic fermentation* referred to above.

The proposed microbiological methods of retting are many, but can be brought under 2 heads: 1) those in which the addition of a selected fer-

rett forms an accessory part; 2) those in which such addition is the principal part. The process devised by the Institute of Agricultural Bacteriology of Portici, and based on the use of the pectic aerobic ferments already mentioned, the prototype of which is the *Bacillus Comesii* (named after Prof. Orazio Comes), also mentioned above will belong to the 2nd group.

This method consists in : 1) immersing the textile materials in ordinary water; 2) raising the whole to the *optimum* temperature of the bacillus in question, from 28° to 35° C., which temperature must be maintained during the entire period of retting; 3) adding a sufficient quantity of pure culture of the bacillus; 4) passing an air current through the entire mass during the whole period of retting.

Theoretically, the water, the textile material and the vessels should be sterilised, but this cannot be done under practical conditions. The safety and the very essence of the method in question (as was shown very fully by the long discussion, with the German Patent Office, which afterwards granted the patent) consists in the fact that the air passing through the mass regularises and intensifies the action of the pectic ferments. The aerator can in this way act rapidly as retting agents, and gain the upper hand over all the other microbes present, which remain inactive.

Any water suitable for retting as practised in rural districts is also suited for the method, and the duration of the operation ranges from 42 to 84 hours, according to the textile material.

The process is very simple and it will be seen that to carry it into practice there are only needed :

- (1) Vats, differing very little from those used by peasants, and feed yes;
- (2) Water for retting the substance, and also if necessary for washing it;
- (3) Heat (steam);
- (4) Air for retting and drying the textile material;
- (5) Ferments.

As regards the industrial application of this method a distinction must be made, as it is more or less easy to apply according to the material treated on, and each textile fabric calls for the solution of a separate problem in this respect.

Hemp. The method of retting under consideration is also applicable to hemp, no matter whether the epidermis remains attached to the hemp stalk, whether it has first of all been detached from it. If there were no other son, however, in view of the great difference involved as regards capacity of the retting plant required, it is certain that the two cases offer two altogether different problems.

Where hemp in the stalk is in question, the required plant consists of : a water pipe, boilers for steam production, a motor for compressing air and also, of course, Decauville engines for conveying the stalks, pumping machinery for supplying and removing water, and better still, an ap-

pliance for mechanical washing of the retted hemp. Drying is carried in the open air as in ordinary retting.

On the other hand the matter becomes more complicated where retting is preceded by green scutching. Nevertheless the latter is always preferable, because this system carries with it the following advantage:

(1) If the scutching is done in the field, only about half the weight of raw material will have to be carried to the retting appliance.

(2) During retting, the macerating capacity will be a little more than $\frac{1}{3}$ superior to that of retting as practised in the country districts, hence

(3) The reduction of the bulk to be treated means a reduction of vat area in the proportion of $\frac{2}{3}$.

(4) A reduction of $\frac{2}{3}$ in water consumption.

(5) A reduction of $\frac{2}{3}$ in consumption of heat and air.

Moreover, it is only by scutching first of all that one of the advantages of industrial methods generally, and the one we advocate in particular, can be really turned to account. The method consists in the following:

(6) The work can be carried out throughout the year. Artificial drying of the stalk would entail enormous expense. Industrial stalk retting is only conceivable during the good season. Precisely the contrary is the case in the retting of the already scutched material, and drying is then one of the easiest operations.

It should also be remarked that these observations on the advantages of scutching before retting presuppose of course that scutching is possible *per se* in the first place, and then in relation to the subsequent retting of the fibres.

It can be proved that scutching is possible, though there are prejudices against it which are chiefly based on the fact that up till now mechanical white scutching or breaking of the retted stalk hemp on the common method is a problem for which no satisfactory solution has been found. There is no mechanical scutcher obviating the necessity of afterwards breaking the hemp by machine, or, better still, hand crushing it, or by hand together. There is also no method which does not leave a considerable quantity of tow and leave the harl very tangled.

On the other hand, there are scutchers capable of reducing from 50 to 67 % of the weight of the stalk, according to the quantity of the harl and which turn out inconsiderable quantities of tow.

These figures prove, it is true, that when scutching is finished, the retting harl is still made up, to the extent of 50.2 to 46.7 %, and at very 28.3 %, of stalk, but this is not a drawback, because retting by its properties as easily effects detachment of the harl from the woody part as do the operations of beating and, above all, washing; finally, however, drying and softening of the harl, cause the disappearance of all the remaining stalk.

It is true, however, that scutching remains a fairly delicate operation because a given machine is not always adapted for handling all kinds of hemp. It has moreover been found that green scutching is more difficult

dvantageous in its results and leaves more stalk adhering, in proportion as the hemp is less dry and the stalk is finer.

As regards the retting of the scutched epidermis, it is quite true that the resulting material differs slightly in appearance from the flax retted in stalks. It is smoother, less divided, more glossy, and above all the strips appear to adhere, but it suffices to put it through a slight process, such as brushing, to render it flexible, as practised in hemp spinning works, in order to get rid of all adhesion and produce an excellent degree of flexibility, division and colour.

Nevertheless it follows from all the foregoing that it would be erroneous to suppose that the method, though admittedly efficient when applied to scutched hemp, may be deemed a simple substitute, though of course cheaper, for the method at present adopted in the country. If this were the case, it would leave unchanged all the other economic relations between the production, the industry and the trade in hemp. This is by no means the case, as the method is destined to bring about a violent change in all those relations, and entails the industrialisation of hemp retting. The hemp grower will be called upon to grow the plant and sell it in the stalks for industrial treatment; it will be the function of the retting factory to ret the hemp after scutching it, then to comb it, or else to sell it direct to the factory which specialises in combing, spinning and weaving the hemp.

The method, in order to gain footing in the practical treatment of hemp, might encounter difficulties of 3 kinds: prejudices, vested interests, and absence of economic advantages.

We cannot here go into the first or the second of these difficulties, which for that matter are more or less common to all innovations and which are gradually overcome. On the other hand it has been necessary to show that difficulties of the third class do not exist. This has been done by methodical official experiments conducted chiefly at Ferrara (Italy) in 1908, afterwards at Mans (France) in 1911, and at Portici (Italy) in 1912. Here it was shown that retting by this microbiological method only takes 84 hours for hemp, without there being any danger of going beyond the *optimum* point of retting; it does not produce any offensive smell, and in ordinary times the cost per cwt is: 3 s. for Italy, 3 s. 8 d. for France, as against 6 s. to 13 s. 8 d. for retting as practised in the countryside. On the other hand the commercial value which this method gives to hemp may amount to more than 32 % above that obtained on the other system.

With such a practical basis, industrial tests cannot be otherwise than successful, and in France, where special cultivation conditions exist, the Société Française du Rouissage industriel at Mans (Sarthe), a limited company founded in September 1912, will work the patent in France, its colonies and Protectorates. A few months later the first factory was set up at Bonnétable, in the district of Mantes.

The factory was built for the retting of scutched hemp, and comprises the following principal sections: *Hemp stocks*, *Decauville light railway* with special trucks for conveying the bundles of hemp to the scutching depart-

ment. *Scutching Department* comprising : a machine for cutting off roots and tops, a drier for the stalks to be scutched, fitted with a boon suction current. *Preparation of cages of scutched hemp and hoist* for conveyance to the retting department. *Retting Department*, comprising a battery of 4 vats of 19.62 cu. yds. capacity each, divided into sub-vats 3ft. 3in wide and 16ft. 3in deep, furnished with a special arrangement for supplying steam, water and air. *Washing and Pressing Department*, containing washing machines and *centrifugal driers*. These different sections are connected with each other by overhead rails with points, for the conveyance of the cages containing the material for retting and that already retted. From the washing section a hoist runs to the *drying department* (with automatic apparatus supplying a current of hot air). There is also a *special department for the production of ferments*, which is fitted with an automatic producing device.

After a starting period which occupied 2 months, the whole of this plant was in regular operation, and the Chairman of the Company wrote in March 1914 that, to their great satisfaction, the shareholders had been able to satisfy themselves of the following :

- (1) The production of ferments by means of cultures supplied by our laboratory had always proved very regular and easy.
- (2) The retting of the hemp was regularly completed in 48 hours.
- (3) The yarns obtained by the *Société textile Alençonnaise* with the hemp retted on our method have been compared with the best quality Italian hemp yarns in regard to fineness and flexibility.
- (4) With these yarns the said Company was able to obtain thread No. 16 dry, while the yarns of Sarthe were never able to go beyond the maximum of 7.
- (5) The plant never produces offensive smells.
- (6) The residual water was discharged into a small stream without occasioning any trouble.

Industrial tests have also been carried out in Italy. One was begun at Giuliano Campania, but was unfortunately stopped at the outset through the war. Another at Coccolia (Ravenna) met with the same fate, and for the same reason. Nevertheless it had already been proved that retting even in stalks, by this method may with advantage replace the system in use in the countryside, as on this method the price per cwt of retted material is 27 s. 5 d. in place of the minimum selling price of 32 s. 8 d.

Flax. The application of the method to flax is, from a technical point of view, absolutely identical with its application to hemp in the stalk. Its operation here again occupied a minimum period of 42 hours. It is at present time being tried on a large scale by the *Société Française du Résage Industriel* at Bonnétal, both for its own account and for account of third persons, to the complete satisfaction of manufacturers. It has an absolutely certain future in all those regions where flax growing is falling off day by day owing to the difficulties created by shortage of labour.

Ramie. The method as applied to ramie (*Boehmeria nivea* and *B. tenacissima*) certainly has a great future. Retting takes 48 to

lours, and is a perfect success both on the stalks and the strips and the derived product called "China-grass". The well known difficulties, however, experienced in getting rid of the cork-like film will hardly allow of applying it except to China-grass. Energetic washing is needed after retting. The resulting fibre, however, differs from the ramie fibre obtained by chemical retting. It differs greatly from silk waste, which the last-named resembles; on the other hand it very much resembles the superfine qualities of flax.

The product obtained is stronger, the fibres are more parallel, and it is easier to obtain long yarns with high yield. It is also possible to carry out bleaching, at least in medium sizes, on the finished yarn, and even to disregard this operation in inferior products and all those which do not need it owing to their purpose. The cost of retting may be estimated at 5s. 8d. per cwt of China-grass in normal times, and the combing yield may go up to 44 %. This method will render ramie-growing possible everywhere, when advances in machinery have furnished the means of producing China-grass by mechanical means. For the moment the industry continues to be completely subservient to the Chinese hand-barked China-grass.

Agave, other Liliaceae, Jute, etc. The method is perfectly well applicable to *Agave Americana*, *Agave sisalana* and *Sansevieria ceylanica*. With regard to the fleshy leaves, they must in the first place be reduced to strips, their tissues roughly crushed, and the product washed after retting. The leaf parenchyma is reduced to a pasty mass easily carried away by water. Drying is very easy, and may be completed in 2 to 3 hours. In 4 days the leaf is reduced to perfect and very white fibre. The retting of jute (*Corchorus*) is also quite successfully accomplished.

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SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

840 - Recent Researches on the Possible Transmission of Animal Trypanosomiasis
Man: the Biological Reactions in Human and Animal Trypanosomiasis with Reference to the Identification of the Virus (1). — LANFRANCHI ALESSANDRO., in *Atti della Reale Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXV, part 8, 1st Half Year, pp. 601-605. Rome, April 16, 1916.

The writer wished to find the limits of efficacy of his serum in the presence of the 3 viruses: *Lanfranchii*, *Evansi* and *gambiense*. To attain this object, while keeping the quantity of virus invariable (0.2 cc.), he varied the quantity of serum, using it in the proportions of: 1 - 0.5 - 0.25 cc. &c. The duration of contact of the 3 viruses with the writer's serum, with normal serum, and physiological serum was 3 minutes in every case. The different mixtures were then inoculated into the peritoneum of white rats.

It was found that the serum had completely exerted its protective action on the animals inoculated:

with the virus *Lanfranchii* when the serum was used in doses 1 - 0.5 - 0.25 cc.; with virus *gambiense*, in doses of 1 cc.; with *Evansi*, in doses of 1 - 0.5 cc.

On the other hand, with virus *gambiense* at the rate of 0.25 cc. it prolonged the course of the experimentally induced disease and with *Evansi* in the same amount the prolongation was still greater.

(1) See also *B.* July 1916, No. 767.

Recent Investigations at the Imperial Institute in London, in reference to Maximiliana Fruits, Tobacco, Coffee, Medicinal and Poisonous Plants, and Silk. — *Bulletin of the Imperial Institute*, Vol. XIV, No. 1, pp. 1-44. London, January-March 1916.
Cokerite fruits and oil from British Guiana. — The fruits of the cokerite were identified by the Royal Botanic Garden of Kew as belonging to species of *Maximiliana*, probably *M. regia*. Their structure is similar that of the fruits of *Elaeis guineensis*, and, like the latter, they furnish distinct oils : that of the pericarp and that of the kernel. An examination of the samples forwarded to the Imperial Institute gave the results out in Tables I, II and III.

TABLE I. — Percentage composition of Cokerite fruit by weight.

Bracts	12.4	Shell	53.6
Pericarp	17.0	Kernel	17.0
Average weight of a fruit	10.6 gms.		
Average weight of a nut (fruit without bract or pericarp)	7.5 gms.		
Average weight of kernel	1.3 gms.		

TABLE II. — Composition of Cokerite oils.

	Pericarp oil	Kernel oil (3)
Specific gravity at 100°C	—	0.8668
Specific gravity at 15°C	—	
Melting point (in open tube)	—	27°C
Solidifying point of fatty acids	25.5°C	24.2°C
Acid value (1)	28.6	3.1
Saponification number (1)	211.6	253.0
Iodine number	51.4 %	13.0 %
Fehner value	—	88.9
insoluble fatty acids	—	88.6 %
non-saponifiable substance	—	0.3 %
soluble volatile acids (2)	—	3.0
insoluble volatile acids (2)	—	7.0

TABLE III. — Percentage composition of a cokerite kernel cake, calculated for a cake containing 7% of fatty substance (4).

Water	8.6 %	
Crude protein 15 % /	True protein	14.7
	Other nitrogenous substances	0.3
Fat	7.0	
Starch, etc. (by difference)	52.5	
Cellulose	12.0	
Ash	4.3	
	100.0	
Nutritive ratio	1:7.4.6	
Nutritive units	108	

⁽¹⁾ Number of mg. of potash for 1 gram of oil.⁽²⁾ Number of cc. of decinormal alkali needed to neutralise acidity in 5 gr. of oil.⁽³⁾ Prepared at the Imperial Institute.⁽⁴⁾ The kernels contained 11.3 % of moisture and yielded 56.9 % of fat.

From a comparison with the oils and cakes of *Elaeis guineensis* & *Cocos nucifera* it is found that those of cokerite are almost equal in value. The problem in the utilisation of this fruit is to design a machine by which the nuts can be crushed.

Nyassaland Tobacco. — Of late years, tobacco has become the chief export article of Nyassaland. In 1914-1915, 3,308,948 lbs. were exported of a value of £ 82,735 (on the spot). This figure is slightly below that of the previous year. In 1915-16, tobacco growing covered 9,042 acres. Almost the whole of the exports go to the United Kingdom. The average unit production was rather low in the last period of 6 years; it ranged between 305 lbs. per acre in 1912-1913 and 520 lbs per acre in 1910-1911. The district of Blantyre furnishes nearly $\frac{2}{3}$ of the production. The varieties most grown are: "Gold Leaf", "Warne", "Conqueror" and "White Stem Orinoco". From experiments carried out in the last 2 years by Nyassaland Department of Agriculture, it results that "Gold Leaf" is perhaps the best adapted variety for the greater part of the Nyassaland where tobacco is grown. It is of good cropping power and seems to possess the largest proportion of light coloured leaves. Twelve varieties of tobacco were cultivated in 1914-1915 at the Government of Nyassaland Experimental Station. The crop samples sent to the Imperial Institute contained from 12.5 to 14.7 % of moisture, from 1.8 to 3 % of nicotine, from 1.2.9 % of nitrogen, from 11.0 to 12.8 % and in one case, 18.2 % of ash. They were valued (October 1915) at from 4d. to 7d. per lb. The ash always contained a good deal of potash, a few sulphates and a few chlorides. The burning qualities of the tobacco are excellent.

Uganda Coffee. — Coffee cultivation is making rapid strides in Uganda. It is the chief crop of farms under European management, on which *Coffea arabica* occupies 9,551 acres and *Coffea robusta* 367 acres. Coffee is planted with *Hevea brasiliensis*, which covers 4,835 acres (the greater portion of this area is planted with trees under 2 years old); it is also cultivated by the different Missions, over an area of about 660 acres, and by the natives in an area of 8,692 acres (estimated). These figures relate to 1914-1915, in which years 18,998 cwt of coffee in the parchment (unhusked) of a value of £ 35,000 were exported. Two samples sent to the Imperial Institute for examination were estimated after husking at 54/- to 55/- per cwt. in London (December 1915).

Drugs supplied by African Solanaceae. — The percentage of hyoscyamine (with which it is easy to prepare isomeric atropine, now rare on the market), was determined at the Imperial Institute in specimens of *Hyoscyamus muticus* coming from the Soudan, and *Datura stramonium* from Egypt, the Soudan and South Africa. The results were shown in Table IV.

While the seeds of *D. Stramonium* from the Soudan are of no industrial value for the extraction of hyoscyamine, the leaves of the same species, coming from South Africa are well adapted for this purpose. In all cases, total alkaloids were constituted almost exclusively by easily crystallisable hyoscyamine.

TABLE IV. — Total percentage of alkaloid in the samples of *Hyoscyamus* and *Datura* (percentage of dried substance).

<i>Hyoscyamus muticus</i> : leaves and stalks	0.770 %
<i>Datura Stramonium</i> from Egypt : stalks and fruits	0.138
" " " " leaves	0.320
<i>D. Stramonium</i> from the Sudan : stalks, and fruit cases	0.130
" " " " seeds	0.096
<i>D. Stramonium</i> from South Africa : leaves	0.540

Medicinal and poisonous plants from South Africa (1). — A summary of the results hitherto obtained at the Imperial Institute from a study of the following species : — *Senecio latifolius*, producing the " Molterno disease " in livestock ; — *Acokanthera venenata* ; *Ornithoglossum glaucum* ("Cape angkop") a poisonous pasturage plant ; — *Homeria pallida*, causing great losses of livestock yearly in the Transvaal ; — *Crotalaria Burkeana*, causing a disease known as " stiff sickness " in livestock ; — *Chailletia cymosa* (= *Dichapetalum cymosum*), known in S. Africa as " Gift-blad ", one of the most African plants most injurious to cattle ; — *Strychnos Henningsii* : Eastern Pondoland, by infusing the bark of this plant in alcohol, bitters are prepared which are used as an aperient ; the bark and the fruits contain still unidentified alkaloid ; — *Goniaea Kamassi* which contains alkaloid in its bark ; *Mesembryanthemum Mahoni* — the roots of which contain a large proportion of oxalates, a yeast (*Torula*), and the moulds *Mucor erectus*, *Aspergillus oryzae*, as well as *Rhopalocystis nigra* (= *Aspergillus niger*), used in the preparation of an intoxicating and poisonous liquor by the natives of the Transvaal and as yeast for bread by the whites ; — *Raphiolepis divaricata* : its roots yield by fermentation an intoxicating and poisonous liquor employed by the natives ; — *Datura Stramonium* ; — *Barosma usitata* — *Kaempferia Ethelae*, the dried tubers of which are used in the popular medicine of the Rand natives ; — *Bersama Tysoniana* — the bitter bark of which is used as a drug by the natives ; — *Chrysophyllum viride* and similar species : from their bark a substance resembling saponin is extracted ; — *Urginea Burkei* — which causes heavy losses of livestock in South Africa ; — *Buxus Macowanii* : its wood, known as " South African boxwood " or " Cape boxwood " is adapted for turning and wood carving work like that of *B. sempervirens*, when certain precautions are taken in cutting and drying it. It abounds in the forests of Alexandria, Cape Province, and more in those of Transkeian.

Trinidad Silk. — A first attempt at silkworm breeding was made in Trinidad in 1868, in which year *Attacus ricini* was introduced and successfully reared in that island. In 1893 there were imported : *Antheraea pernyi* ; *Attacus cynthis* ; *Tetra polyphemus* ; *Callosamia promethea*. The first named was successfully reared on leaves of *Terminalia Catappa* ; the second on leaves of the castor oil plant ; the cocoons obtained were finer than those imported ; the other two were not successful. Further experiments prove that *Attacus cynthis* can be acclimatised in Trinidad. *Bombyx mori* was imported there in 1907. Up to now its rearing has been rather

¹ See also *B.* March 1915, N° 246.

(Ed.)

ther limited; it has not been attacked by any disease; two breeds are reared, one with yellow, the other with white silk. Crosses between these have also been made. In Trinidad there is a wild silkworm, *Attacus hesperus*, which feeds on the leaves of *Casuarina* sp.; it can be reared artificial but the moths must be enclosed in cages for mating and oviposition.

Specimens of cocoons of *Bombyx mori* (yellow and white), *Attacus, cini* and *Attacus hesperus* examined at the Imperial Institute were found be of good quality.

There is no doubt that silkworm rearing can be successfully established in Trinidad. Of the different species there tested, those yielding the best results are *Bombyx mori*, and especially *Attacus ricini*, which stands high temperatures and furnishes more easily handled cocoons.

CROPS AND CULTIVATION.

SIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

842 - On the Origin of "Red Soil". — MANASSE E., in *Giornale di Geologia Pratica*. XI Year, Part III-IV, pp. 101-103. Parma and Pisa, 1915. (1).

Trial analyses were made of two red soils from the "Montagnola" of Sienna, namely, a complete analysis, treatment with hydrochloric acid in the presence of kaolin, attack by sulphuric acid, solubility in hot dil potassium hydroxide. From these experiments it would appear that 1) the alumina to a fairly large extent, almost the whole of the ferric oxide a smaller proportion of the silica, and the slight amount of sesquioxides of manganese present, are in the form of colloidal hydroxides in the two soils; 2) the rest of the alumina is mostly in the state of clay (kaolinite but also to a lesser extent in the form of silicates of aluminium, potassium and sodium with and without iron and magnesium (micaceous minerals); 3) the excess of silica must be attributed to quartz; 4) while the lime in the two red soils is due almost exclusively to calcium carbonate, the magnesia is only attributable in part to the carbonate of magnesium, the rest belonging to silicates which are little soluble or insoluble in hydrochloric acid.

In conclusion, the two red soils examined did not consist exclusively of a clayey ochreous-quartzite matter as they also contained hydroxides of iron in the colloidal state, accompanied by gelohydrates of aluminium and in smaller quantities, by silica and manganese. The two Sienna earths present a great analogy in this respect with those of Croatia, which are considered similar to bauxites from the physical, mineralogical, genetic point of view.

With regard to the genesis of the red earths in question, the author is inclined to consider them as deposits of colloidal solutions mixed with matters originating from the alteration and weathering of anagenetic, schistose, phylladic, quartzose, etc. rocks which in the "Montagnola" of Sienna are company cavernous limestone, not excluding however the action of ruginous thermal waters slightly impregnated with manganese and carbonic acid gas.

(1) See Vinassa de Rigny P., "Red Soil", *Bulletin September 1915*, pp. 1131-1138. *E*

- *Researches in Agricultural Bacteriology carried out in Denmark during the Period 1904-1914.* — CHRISTENSEN H. R. (Director of the State Agricultural Laboratory). — *Communication made to the International Institute of Agriculture by its Correspondent for Denmark, Baron de Rosenkrantz.*

These investigations were carried out during the period 1905-1909, in laboratory of agricultural bacteriology of the Royal Higher School of Veterinary Medicine and Agriculture under Prof. Weiss and, from 1909, in State Agricultural Laboratory, the direction of which was taken over the same gentleman.

I. — *Two fluorescent denitrifying Bacteria.* — These two bacteria, isolated by the writer, are distinguished from all other fluorescent denitrifying bacteria by the fact that they do not liquefy gelatine. One of them, *c. denitrificans b.*, is capable only of reducing nitrates, while the other, *c. denitrificans a.*, reduced both nitrites and nitrates (1).

II. — *New Principles of Analysis of Soils in connection with certain as to the presence and distribution of Azotobacter chroococcum in various types of soils.* — Preliminary considerations as to the progress of soil research in connection with rural economics; the hygroscopic qualities of soils in Denmark; the importance of the methods of RÖDERWALD and SCHERLICH for determination of hygroscopicity, growth in area of particles of earth, the state of subdivision of soil; on the need for studying reaction and basic quality of the soil, being properties closely bound up with its microbiological condition. After glancing at the principles hitherto adopted in bacteriological analyses, the writer gives notes on the result of his investigations of a nitrogen-fixing bacillus, *Azotobacter chroococcum*. Determining the factors causing its presence in the soil, the method was adopted of comparing an ordinary culture of the soil with other cultures in which large quantities of the microbe had been inoculated whose specific behaviour in different types of soil it was required to study in order to ascertain whether the differences in the tendency to decompose given substances are to be attributed to the microbiological or chemical conditions of the soil. It was found that the presence of a growth of *Azotobacter* in a solution of mannite (1 litre of distilled water, 20 grms of manmite and 5 grms of bipotassic phosphate) is a reliable indication of the presence of compounds of calcium and magnesium in the soil in question, and may form the criterion for determining the basic quality of the soil. This is perhaps the first example of a specific property of the soil investigated by microbiological methods. An analogous process is represented by the investigations of the presence in the soil of readily soluble phosphoric acid (2).

III. — *New Biological Method for Determination of alkaline Carbonates in Soil.* — There are soils which, when brought into contact with a solution of mannite freed from lime and inoculated with *Azotobacter*, are un-

1. *Cytalblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten* II, Vol. XI, p. 14, Jena, 1904.
2. *Fortschritte der Landwirtschafts-Plantenkd.*, Vol. XIII, pp. 148-193, Copenhagen, 1900.

able to promote the growth of an azotobacterial flora. If calcium sulphate is then added to the solution, all the soils do not behave in the same way; some a regular growth of the *Azotobacter* is observed, and no growth of the others. These differences in behaviour are taken to be due to the percentage of alkaline carbonates, which varies from soil to soil. This furnishes the elements for a new biological method of determining the content of the soil in basic substance (1).

IV. — *Enquiries into the Relation between the Composition of the Soil and the Presence of Plasmodiophora brassicae.* — Applying the microbial method for determination of the soil reaction, the Writer was able to demonstrate the existence of a fairly close relation between the presence of *Plasmodiophora brassicae* and the alkalinity of the soil. The greater the reduction in the latter, the greater the likelihood of attack, which is almost impossible in a markedly alkaline medium. I. KÖRPIN RAVN studied the relation between the behaviour of the soil and the presence of various grass plants, arriving at the conclusion that the terms *calcifuge* and *calciphilous plants* ought to be replaced by the terms *basifugal* and *basiphilous plants*, or *acidifugal* and *acidiphilous*. Acidiphilous species would be: *Rumex acetosella*, *Raphanus raphanistrum*, *Viola tricolor*, *Scleranthus annuus*, *Cynaphalium uliginosum*, *Spergula arvensis*; and basiphilous species, *Sinapis arvensis* and *Veronica agrestis* (2).

V. — *On the Fixation of atmospheric Nitrogen by free Microorganisms.* — A comprehensive study of the most important researches in connection with this question, and the results obtained by the Writer's experiments (3).

VI. — *In connection with the decomposition of Urea.* — A preliminary note to a study of the action of humus compounds on the splitting up of urea into ammonia (4).

VII. — *Investigations in reference to determining the Lime Requirement of the Soil* (5).

VIII. — *Influence of Humus on the Ammonification of Urea.* — The generally adopted opinion that humic substance cannot supply organisms with carbon as a food is incorrect. It results from these investigations that, in reality, many microbes capable of splitting up urea can not only utilise humic substance, but even prefer it to all the other compounds of carbon experimented with (laevulose, xylose and various organic acids). There are also organisms which possess the property of decomposing urea even in absence of any other organic substance, utilising it as a nutrient medium.

(1) *Tidsskrift for Landbrugets Plantearv*, Vol. XIV, pp. 292-294. Copenhagen, 1907. — *Zentralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten II*, Vol. XIX, pp. 735. Jena, 1907.

(2) With Kolpin-Ravn F. and Harder P. *Tidsskrift for Landbrugets Plantearv*, Vol. 1, pp. 430-476. Copenhagen, 1909.

(3) *Tidsskrift for Landbrugets Plantearv*, Vol. XVI, pp. 303-336. Copenhagen, 1909.

(4) *Zentralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten II*, Vol. X, p. 130. Jena 1909.

(5) With Larsen O. H.; see *Bulletin for January 1911*, No. 50.

is *Urobacillus Beijerinckii*, isolated and carefully studied by the writer (1).

IX. — *Method of determining the Capacity of the Soil for decomposing cellulose.* — This new method described by the writer presents the advantage that by adopting a substance made up exclusively of the compounds of nitrogen required for the nutrition of the microbes and containing no utilisable nitrogen or mineral substances (in this case filter paper without ash) the rapidity with which cellulose is decomposed must be related to the quantity of cellulose contained in the soil in a form accessible to microbes (2).

X. — *Further Researches into the Formation of Nitric Acid in Stable manure and the Soil.* — A critical review of the literature on this question (3).

XI. — *Microbiological Researches into Peat Soils.* — In the first part his work the Author deals with the characters presented by the flora of cultivated peat soils; in the second, with the chemical composition of these soils, and finally, in the third, with the microbiological state of peat brought under cultivation. From this last point of view, he notes a difference between peat beds formed by sphagnum and infra-aquatic beds. The former are distinguished by their feeble tendency to split peptones, their high denitrifying power, their very weak capacity for decomposing cellulose and mannae. Infra-aquatic peats exhibit a diametrically opposite behaviour, and it is of interest to note that these peats in addition to having a strong acid reaction, contain a considerable number of nitrogen-fixing bacteria. It must consequently be supposed that the existence of these differences between the two formations will facilitate the study of yet unexplored peat beds (4).

XII. — *Determination and Significance of the Reaction and Basic Quality of Soil.* — A report submitted to the International Congress of Agriculture at Ghent in 1913, and forming an exposition and a critical examination of the methods proposed by the author for determining the basic reaction of the soil, the putting into practice of these methods and their importance in soil research. It is indispensable that landowners should know the reaction and basic quality in order to draw logical conclusions as to agricultural methods.

XIII. — *Relation between the Properties of the Soil and the Utilisation of different Phosphates.* — The tricalcic phosphate found in bones and na-

¹ *Tidsskrift for Landbrugets Plantearv*, Vol. XVII, pp. 79-100. Copenhagen, 1910. — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten II*, Vol. XXVII, pp. 362. Jena, 1910.

² *Tidsskrift for Landbrugets Plantearv*, Vol. XVII, pp. 356-359. Copenhagen, 1910. — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten II*, Vol. XXVII, pp. 444. Jena, 1910.

³ *Tidsskrift for Landbrugets Plantearv*, Vol. XVIII, pp. 167-170. Copenhagen, 1911. — With Mentz A. and Overgaard O.: *Tidsskrift for Landbrugets Plantearv*, Vol. XIX, pp. 155. Copenhagen, 1912. — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten II*, Vol. 37, pp. 411-430. Jena, 1912.

tural phosphates is difficult to utilise in basic soils; the use of fertilisers of this kind must therefore be carefully avoided in soils shown by micro-biological analysis (i. e. with Azotobacter) to be basic. On the contrary, there cannot be any relation between the reaction and basic quality of the soil, the one hand and the utilisation of superphosphates and basic slag on the other, nor yet between the property of assimilating phosphates difficult of solution and the capacity of setting free acids, as for instance acetic acid from calcium acetate (1).

XIV. — *Influence exercised by the Nature of Earths on the Bacteria and Chemical Condition of the Soil* (2).

844. Conversion of Soluble Phosphoric Acid into Insoluble Phosphoric Acid in the Soil under the Influence of Physical, Chemical and Biological Factors. — SKAL'KII, Южно-русская Сельско-хозяйственная Газета (Agricultural Gazette of Southern Russia), XVIth Year, Nos. 33, 34, 36, 37 and 38, pp. 6-7; 6-7; 7-8; 9-10 and 6-8. Kharkov, 1915.

The experiments were carried out at the agricultural experiment Station of Ploty (Podolia), where, for several years running, both by chemical analysis of the soil and experiments conducted in the laboratory and in open field, it was ascertained that among the principal elements of fertility in the soil of the Station, classed as "tchernoziom", the most deficient was phosphoric acid, that is, in a form which could be readily assimilated by plants (3).

The object of the experiments was to study the intensity of fixation of phosphoric acid soluble in water, added to the soil, under the influence of chemical, physical and biological factors, in various layers of soils under different cultural conditions. By biological factors is meant the action of the micro-organisms of the soil and that of plants. In the experiments undertaken, plants were excluded. Consequently only the fixation of phosphorus by micro-organisms was studied.

The experiments were conducted with 4 different soils: April fallow soil, i. e. that begun to be tilled in April; soil which had been uncultivated for many years; kitchen-garden soil; and finally the soil of an old oak wood. Two layers were studied in each of these lands, the one arable 0 to 15 cm. deep, and the other below the first, from 17.7 to 35.5 cm. deep. For each experiment a quantity of earth corresponding to 1 kilogram in absolute dry condition was taken. The experiments are divided into 2 series:

(1) *Tidsskrift for Landbrugets Plantearv*, Vol. XX, pp. 90-104. Copenhagen, 1913. — *Ring's landwirtschaftliche Zeitung*, Year LXII, pp. 392-405. Stuttgart, 1913.

(2) See B. June 1915, No. 682.

iEd.

(3) In the publication of the Department of Agriculture «Сельско-хозяйственный промысел в Р. П. России» (Agricultural Industry in Russia), (1895-1913), Petrograd, 1913, published in Russian and French, it is stated, in connection with the Ploty Station (in a chapter where brief particulars of the scientific work of the principal Russian Agricultural Experiment Stations are given), that "its investigations in connection with the conditions affecting the contents of the soil in two principal elements of fertility, nitrogen and phosphorus, have gained it a wide reputation". The results of the experiments summed up in this article supplement those which appeared on page 188 of the publication in question.

In the first there was added to each sample of earth in addition to water soluble potassium phosphate (1.3312 g. of P_2O_5), 3.605 g. of potassium nitrate in order to observe how this addition affects the total fixation (i. e. that due to physical, chemical and biological factors) of soluble phosphoric acid. These experiments were made with the April fallow soil and the soil being out of cultivation. In the second set of experiments part of the soil was treated with chloroform, to suspend bacterial life and consequently the fixation of phosphorus by these bacteria; the other part of the soil not being so treated. The object was to differentiate the fixation of soluble phosphoric acid produced by physical and chemical factors from the biological fixation due in this case to the activity of the micro-organisms. The quantity of chloroform added was 50 cc. and that of phosphoric acid the same as in the previous case.

To all the samples of air-dried earth 35 per cent by weight of water was added, to stimulate activity of the micro-organisms; in order to prevent evaporation of water the samples were put into big bottles with ground glass stoppers. During the entire continuance of the experiments (3 months) the temperature ranged between 15° and 25° C. The external appearance of the samples remained normal until the end of the experiments. On completion of the latter, the soluble phosphoric acid, which had remained as such in the soil, was extracted by distilled water, of which 10 litres per sample were added. The duration of treatment with water was 8 hours. Care was taken to shake up the solution every 15 or 20 minutes.

The results of the experiments are summed up in the appended Table. From the results obtained the writer deduced the following conclusions:

- 1) The process of fixation of water-soluble phosphoric acid depends on the chemical and physical factors and on the biological factors of soil.
- 2) The intensity of total fixation of the said acid is in direct relation to cultural conditions of the soil.
- 3) The intensity of total fixation of the said acid increases with the addition of potassium nitrate to the soil.
- 4) The process of fixation of water-soluble phosphoric acid in the μ -chloroformed, i. e. the natural, samples of earth takes place with greater intensity than in the chloroformed samples.
- 5) The total intensity of fixation and the physical and chemical fixation of water-soluble phosphoric acid is less in the arable layer (from 0 to 17.7 cm depth) than in that lying immediately beneath (from 17.7 to 35 cm).
- 6) The intensity of the process of assimilation of phosphorus is greater in the arable layer than in that immediately beneath.

For better study of the phenomenon of assimilation of phosphorus the writer also carried out experiments on the bacterial flora of each of the samples of soil capable of multiplying in peptonised meat bouillon, with agar or bactine, dilute to 0.001 and 0.0001. By calculating the number of bacteria per gram of absolutely dry soil, data were obtained from which it may

Fixation of Phosphoric Acid soluble in water, in percentages of the quantity added to the soil (1. 3312 g. of P₂O₅).

Fixation of water soluble phosphoric acid	In the layer from 0 to 17.7 cm. deep.		In the layer from 17.7 to 35.5 cm. deep.		Percent. diff.
	APRIL fallow Uncultivated land	KITCHEN garden soil	APRIL fallow Uncultivated land	KITCHEN garden soil	
A. 1st Series of Experiments.					
I. Total fixation (supplying potassium nitrate)	89.89	87.93	—	—	92.50 89.87 —
II. Total fixation (without potassium nitrate)	87.14	84.04	—	—	91.64 86.92 —
B. 2nd Series of Experiments.					
I. Total fixation (in chloroformed soil)	87.14	84.04	84.06	75.28	91.64 86.92 84.11 83.
II. Physico-chemical fixation (in chloroformed soil)	—	—	—	—	84.90 81.92 82.58 73.16 89.94 86.05 83.29 83.
III. Biological fixation due to micro-organisms, or assimilation	2.24	2.12	1.18	2.12	1.70 0.87 0.82 0.

be deduced that the quantity of these bacteria increases with the improvement of the cultural condition of the soil.

As regards the relations between the quality of the bacterial flora of the soil and the intensity of assimilation of phosphorus, it is stated that there no possibility of ascertaining them by means of the data obtained. There are however some indications pointing to the existence of such relations.

MANURES
AND
MANURING

845 - Rapid and simple Determination of the Nitrogen in Liquid Manure by means a Densimeter. — VOGEL, in *Illustrierte landwirtschaftliche Zeitung*, 36th year, No. 1, pp. 277-278, 1 fig. Berlin, May 13, 1916.

Many endeavours have been made to devise a good method by which farmers might themselves rapidly and accurately ascertain the value of liquid manure, but hitherto without much success. Thus, von AHR observed certain relations between the specific gravity on the one hand and the proportions of dry substance and nitrogen on the other by means of which a fairly accurate and practical method might be contrived; VOX FERMA has also published some notes which suggested a certain relation between the specific gravity and the content of nitrogen.

The recent experiments of the writer have shown that there is a reliable relation between the specific gravity and nitrogen where the liquid manure is fermented to a sufficient degree. The more the composition resembles that of fresh urine, the less evident the relation becomes. In order to be able to establish the relation clearly, 80 per cent of the total

rogen must be in the form of ammonia. The urine at the time of analysis is therefore not be too fresh ; it must have been in the pit for at least to 14 days. It was also found that fairly wide variations of the nitrogen content are accompanied by only slight variations in the specific gravity, so that the relation differs according to whether the urine is from cattle or a mixture from different livestock. In cattle, urine relations are more regular.

On the strength of these observations the writer designed a densimeter which enables the nitrogen content of the urine to be rapidly ascertained with fair accuracy. His observations referred only to pure cattle urine. The densimeter very much resembles that for measuring the density of milk; in the latter case, it is immersed in the liquid in question and the number of degrees read off on the scale ; the temperature of the urine should be from to 17° C. The greater the number of degrees shown, the smaller the content of nitrogen and vice-versa.

The percentage of nitrogen was ascertained in the urine of a number of different animals by means of the densimeter and the chemical method ; it was found that the result is almost the same by the two methods. The percentages ascertained by means of the densimeter are as follows :

Specific gravity of urine	Quantity of nitrogen found in 1 litre of urine
Up to 1.01	Up to 2 gms.
1.01-1.017	2.3
1.017-1.020	3.4
1.020-1.027	4.5
1.027-1.032	5.6
1.032-1.038	6.7
More than 1.038	More than 7

The densimeter consequently furnishes a means of examining the majority of the cattle urines used in practice. On the basis of these data it is possible to calculate the quantity of liquid manure to be used when grass-land is to be manured with a given quantity of nitrogen. For instance, if the densimeter shows the proportion of nitrogen of 4 to 5 gms per litre and the grass-land is to be manured with 30 kg of nitrogen per hectare (26.8 lbs per acre), from 6000 to 7500 litres (534-668 gallons per acre) of urine must be used.

The addition of a small quantity of water to the urine does not very much affect the result, but a large quantity is injurious.

The densimeter is made by the firm of HUGERSHOFF in Leipzig.

¹ Experiments on Humogen or Bacterised Peat (The Woburn Experimental Station of the Royal Agricultural Society of England, Pot Culture Experiments, 1915, IV).

² VOLCKER J. A., in *The Journal of the Royal Agricultural Society of England*, Vol. LXXVI, pp. 357-363 + plates 9-10. London, 1915.

The humogen or bacterised peat of PROF. W. B. BORROMLEY was compared with nitrate of soda and with controls : 1) in pots containing respect-

ively oats, peas and mustard; 2) in the open field planted with oats. The humogen used was of the chemical composition shown in the following Table.

Chemical composition of the humogen.

	Dry sample	Wet sample
Water	51.49 %	74.42 %
Organic substances	25.66	22.30
Mineral substances	22.85	3.28
	100.00	100.00
Total nitrogen	1.49 %	1.38 %
Nitrogen soluble in water	0.08	0.48

In the pot experiments, in accordance with the instructions of PROBTOMLEY, bacterised peat was used at the rate of 1 part to 9 or 19 parts of soil, i. e. 89.4 or 44.7 tons per hectare, and the equivalent of nitrate of soda used for moist humogen was in the proportion of 20.9 or 10.4 cw per acre.

The results of the pot experiments demonstrate that under the conditions existing when plants are grown under glass are regularly watered and looked after, a good dressing with humogen may produce a considerable development of the green parts, and consequently promote the growth of green forage plants, but it has no advantageous effect on seed production. Under the natural conditions of growth in the open field it was not possible in ordinary crops to detect any advantage resulting from the use of humogen in quantities suitable for the practical farmer, or at the rate of 5 c per acre (1).

AGRICULTURAL
BOTANY,
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS.

817 - *Growth of the Root System of Medicago sativa.* — SUSTOVSKIY, in *Русский Сельско-Хозяйственный Газета* (The Agricultural Gazette of Soviet Russia), Year XVII, No. 30, pp. 6-7. Kharkov, August 1915.

The following experiments were carried out by the Plant-Breed Section of the Regional Agricultural Experiment Station of Kharkov, the object being to study of the growth of the root system of *Medicago sativa* its different phases of vegetation.

Lucerne from a farm in the province of Ekaterinoslav was sown in Rotmistrov boxes placed in the ground without any cover and filled with soil from a lucerne field of the Station. Sowing was carried out on the 2 April, with ungerminated seeds, at the rate of 10-20 to each box. On 2-3 May, all the plants except one were removed from each vessel. For some time, namely until the plants had grown robust, they were watered everyday; they were then allowed to grow under natural conditions, with only occasional watering, once or twice a week.

The roots were separated by washing with water six times, namely when the plant had reached the age of 1, 2, 2 1/2, 3, 3 1/2 and 4 months.

(1) See this *Bulletin*, May 1916, No. 10.

ach of these operations 2 plants were used, one as control. The results of the experiment are contained in the following table:

Growth of the aerial and subterraneous portion of Lucerne.

Vegetative phase of the plant	Aerial portion				Roots				Root coefficient (1)	
	General habit of the plant		Length in cm.	Length in cm.	Horizontal extension in cm.					
	basal	control			basal	control	basal	control		
—	1 stalk	8	0	17	10	—	—	—	—	
—	1 stalk	12	10	44	35	—	—	—	—	
—	1 stalk	17	28	51	45	—	—	—	—	
flowering	tuft	37	40	103	110	75	73	7725	8030	
early maturity	tuft	—	—	104	107	75	84	7815	9523	
completely mature	tuft	40	42	108	115	102	91	11664	10495	

(1) The root coefficient is the product of the length of the root by its horizontal extension.

analysing the data contained in the table it is seen that the growth of the system of lucerne continues uninterruptedly from germination to ripification. Nevertheless, it is not uniform. Up to the age of 2 $\frac{1}{2}$ months, growth takes place with a certain uniformity; at the end of the first month the maximum length of the roots was from 17 to 10 cm.; at the end of the second month 44 and 35 cm. and at the age of 2 $\frac{1}{2}$ months, 51 and 45 cm. in the two following weeks, which form the pre-flowering period and floral flowering period itself, the growth of the root system was very intense, giving as the result at the end of the third month a length of root from 3 to 110 cm. So great a fluctuation in the growth in length of the root system was not observed either before or after this period. The writer regards this fact as essential in his investigations.

It is interesting to note that the results of the experiments carried out by the writer agree with those obtained earlier with the same plant, i. e. same by V. G. ROTMISTROV, but better specify the process of growth of root system of this plant, by establishing the period of the most intense growth in length. This it was not possible to ascertain from the experiments ROTMISTROV, because he only separated the roots by washing 4 times, namely, 14 and 21 days after germination, and at the beginning of flowering ripening.

848 - The Taxonomic Value and Structure of the Peach Leaf Glands. — GREGOR T., in *Cornell University Agricultural Experiment Station of the New York State C. of Agriculture, Bulletin 305*, pp. 183-222 + 9 plates. Ithaca, N. Y., November 1913.

Since the early part of the nineteenth century, the leaf glands have been used by all systematists in the classification of peaches and nectaries. Recently some doubt has arisen as to the advisability of using them for classificatory purposes because of their variability.

In a large number of cases the glands are stable and can be safely used to aid in the identification of certain varieties. There are also varieties in which the glands are exceptionally unstable, being on the border line between the two types — reniform and globose — and having what might be termed mixed glands. These mixed glands are of two kinds: one in which the majority of the glands are reniform, intermingled with globose forms, the other in which the globose form predominates. It would be quite possible, as CARRIÈRE (1867) suggests, to distinguish a third type of gland — the mixed type. It is important that leaves should be chosen from healthy branches on bearing trees. It is also best to obtain a large number of leaves or to examine the tree carefully before making the final selection of leaves. Mature leaves are best because their glands are full-sized and correctly shaped, while on young leaves the form of the glands is usually vague, old, partly decayed, globose glands frequently have much the appearance of reniform glands.

The structure of the glands shows that they are true glands, having an upper layer of long, rectangular, secretory cells that produce a secretion, the function of which is not apparent. After the glands have ceased secreting they begin to decay, becoming brown on the upper surface and slowly disappearing until almost nothing is left. This decaying is a very complicated process, being preceded in every case by a suberization and thickening of the cell walls. The spines of the leaf are very similar to the glands in structure, having the same upper layer of long cells, but with more heavily cutinised walls. A study of the transitional forms indicates that the glands are merely modified leaf spines.

The leaves with reniform glands are apparently the highest type and the glandless leaves the lowest, with the transition through the globose type.

The serrations of the glandless leaves are very strikingly different from those on a leaf with glands. The former leaves are deeply and doubly serrate, while the margins of the latter are always single and crenate. Most invariably, when glands develop on a normally glandless leaf, the serrations are transformed to crenations, indicating that there is a close correlation between the glands and the crenations on the edges of the leaves.

In the appendix a list of 29 works on the subject is given.

9 - The Root Nodules of *Ceanothus americana* and of *Cycadaceae*. — I.

BOTTOMLEY W. B., *The Root Nodules of Ceanothus americanus*, in *Annals of Botany*, Vol. XXIX, No. 116, pp. 605-610 + pl. XXVIII. London, 1915. — II. SPRATT E. R., *The Root Nodules of Cycadaceae*. *Ibid.*, pp. 619-625 + pl. XXIX.

1. The writer examined root-nodules from species of *Ceanothus* growing wild in North America, where the genus is indigenous. Nodule-bearing roots from two different species were examined: *Ceanothus americanus* L. (New Jersey tea) and *Ceanothus velutinus* Dougl. (mountain balm). As the preliminary examination showed that the nodules of both species are practically identical, the following description of *C. americanus* applies equally to *velutinus*.

The root-nodules of *Ceanothus americanus* are modified lateral roots. They are perennial and increase in size each year by the formation of endogenous outgrowths (branches) similar in structure to the primary branch.

Each primary nodule and branch when fully grown shows four zones: *a* an apical meristematic zone; *b* an infection zone, where the cortical cells are becoming infected with bacteria; *c* a bacterial zone, containing many radially-elongated enlarged cells filled with bacteria; *d* a basal zone most free from bacterial cells.

The younger bacterial cells contain rod-shaped organisms, the older ones spherical bodies. These latter are the "bacteroid" condition of active nitrogen-fixing rod-shaped bacilli.

The bacteria, when isolated and grown in pure culture, can fix free atmospheric nitrogen, and from their structure, mode of growth and formation of "bacteroids" evidently belong to the *Bacillus radicicola* group.

The paper is accompanied by a bibliography containing 7 references.

II. — Amongst non-leguminous plants it is now recognized that the *Arecaceae*, *Myricaceae*, *Podocarpaceae*, and the genus *Alnus* have root-nodules, which are definitely concerned with nitrogen assimilation. With these the *Cycadaceae* must be associated, because BOTTOMLEY has isolated from the nodules of *Cycas* not only *Bacillus radicicola* but also *Azotobacter*, that which organisms are known to assimilate atmospheric nitrogen. They are, however, of special interest because in their cortex a very definite arrangement, the algal zone, is produced by the presence of an *Anabaena*, which has been described by the writer.

The first part of the present series of investigations was carried out using as material *Cycas circinalis* L. and *Encephalartos Hildebrandtii* A. Br. Bouché and was extended to comprise the genera *Stangeria*, *Macrozamia*, *mita*, *Ceratozamia*, *Dioon* and *Bowenia*.

Root-nodules have been found to occur throughout all the genera of cycads, and as in other non-leguminous plants, they are perennial modified lateral roots which have diverged from their normal growth owing to union with the nitrogen-fixing organism *Bacillus radicicola*. A whorl of cells or a continuous zone of loosely arranged parenchymatous cells is induced at the base of each nodule. The outer cells always become pushed apart and infected by *Azotobacter* and, if suitable conditions prevail, by *Anabaena* also. The presence of the alga stimulates the phellogen to produce

other lenticels, from which and the basal area, a zone of tissue is produced which encloses the original outer cells in which are the algae and bacteria. The algal zone is continuous, except immediately below the lenticels extending from the base nearly to the meristematic apex.

The algal zone consists of a large air-space containing *Anabaena* and *Azotobacter* which is kept intact by papillate cells traversing it from both the inner and other tissues. *Bacillus radicicola* is chemiotactically attracted to the algal zone, thus leaving the cortical cells in which large quantities of starch grains and sphaerophides are deposited, and in *Dioon*, also tannin. No algal zone has been observed in *Macrozamia*, *Zamia*, *Ceratozamia*, and *Boeckea*, but nodules are produced by *Bacillus radicicola* and *Azotobacter*.

The Cycadaceae, a group with many primitive characters, are the only nodule-bearing plants known, in which four organisms are associated together symbiotically, viz. two nitrogen-fixing bacteria, an alga, and the cycad.

A bibliography containing 11 references is appended.

850 - The Enzymes Zymase and Carboxylase in the Storage Organs of the Potato and Sugar Beet. — BODNÁR J. (Chemical Laboratory of the Royal Hungarian Station of Plant Physiology and Pathology, Budapest), in *Matematikai és Természettudományi Füzetek* (Bulletin of Mathematics and the Natural Sciences), Vol. XXXIII, Parts 3 and 4, pp. 32-60. Budapest, 1915.

After reviewing the work of BUCHNER, STOKLASA, NEUBERG, MAZ PALLADIN and KOSTYTSCHEW, etc. the writer sets out his experiments in detail (summarised in several tables) as carried out on the tubers of seven varieties of stored potatoes and on specimens of thoroughly ripe sugar beet.

Conclusions: 1) Zymase can be isolated from the storage organs of the potato and the sugar beet. These results agree with the observations of J. STOKLASA.

2) Even though in some cases there were bacteria in the fermenting liquid obtained, they did not exhibit the property of splitting up glucose in the presence of 2 per cent toluol, in the manner characteristic of alcohol fermentation.

3) The enzyme extracted from the tuber suffering from the disease termed by APPEL "Bakterien-Ringkrankheit" (1) acts on the solution of glucose in such a way that in the fermenting liquid only traces of alcohol can be detected. On the other hand, there is found the presence of an excess of acetic acid due to the action of the soil bacteria (producing alcohol oxidase) on the alcohol formed by the activity of the zymase. The bacteria of the soil had entered in the spore form into the enzyme extracted from the diseased tubers.

4) Under the action of the enzyme isolated from sugar beet suffering with bacillary gummosis, carbonic acid and alcohol were produced

(1) Cf.: O. Appel, Die Bakterien-Ringkrankheit der Kartoffel, in *Flugblatt 36 der Preußischen Biologischen Anstalt Dahlem*, 1906. — P. Soraer, *Handbuch der Pflanzenkrankheiten*, 3rd edition, Vol. I, pp. 398-399. Berlin, Paul Parey, ed., 1909.

ch smaller proportions than in the alcoholic ferment. This phenomenon remains unexplained.

5) Just as in the zymase of yeasts, the presence of NEUBERG's boxylase is also recorded in the zymase of potato and sugar beet.

6) The fact that a product acting exclusively on pyrotartaric acid was aimed, but leaving the sugar solution intact, a property peculiar to boxylase, shows that the latter may also be extracted from the zymase of potato and sugar beet.

7) In the same way as the carboxylase of yeasts, the carboxylase of potato and sugar beet is much less sensitive to a high temperature and different antiseptics than the other zymases.

- **Investigations into the Part played by the Amylase in Potato Tubers.** — I. BODNÁR J. (Royal Station of Plant Physiology and Pathology, Budapest), Relation between the amylase and sugar content in stored potato tubers, in *Kísérletőgyűjti Kötetmények* (Bulletin of the Agricultural Stations of Hungary), Vol. XVIII, Part 4, pp. 739-745, Budapest, 1915. — II. DÓBY G. and BODNÁR J., Amylase in healthy potatoes and in those suffering from leaf curl, *Ibid.* Vol. XVIII, Part 5-6, pp. 956-968, 4 tables, 1915.

I. — According to the enquiries of W. HENNEBERG, the content of starch in the potato influences its keeping powers, those kinds which are rich in sugar exhibiting greater resistance to bacterial decomposition than those with a relatively large sugar content. A high sugar content thus seems to constitute a predisposition to rot, and it is of great importance from a practical point of view to know this content.

The object of the present work was to examine the possibility of finding a relation between the sugar content of stored potato tubers in the resting state and one of its regulating agents (enzymes); in other words to determine, from the proportion of the corresponding enzyme, the total quantity of sugar forming in the tubers in the resting state, and concluding from this whether or not the tubers are adapted for storing. In the total quantity of sugar in the tubers, there was also included the sugar consumed by the respiratory process, because from the point of view of storage, it is important to ascertain the loss of starch occasioned by the respiration of the tubers.

The experiments carried out were for the purpose of determining whether the proportion of sugar in the tuber in a state of rest can be brought into relationship with the activity of the amylase present. The result of the sugar determinations are given: proportion of amylase in 9 tubers, proportion of reducing sugar (glucose), proportion of non-reducing sugar (saccharose), and total sugar content of these tubers. The experiments, which are summarised in several tables, gave the following results.

Maltase was present in the tubers in a state of rest.

There is no regular relation between the proportion of reducing sugar (glucose) in the tuber and the activity of the amylase present; the quantity of reducing sugar does not always increase in proportion with the activity of the amylase.

On the contrary, a certain relation can be found between the activity of the amylase and the proportion of non-reducing sugar (saccharose),

as also between this activity and the total quantity of sugar. Thus, as the increase of activity of amylase, the proportion of total sugar and non-reducing sugar also increases, except in the cases where certain tubers owing to their more intense respiration, contain less sugar than tubers of amylase of equal activity but weaker respiration.

The knowledge of the activity of the amylase is of great importance from the point of view of storage of the potatoes, inasmuch as those potatoes which contain amylases of higher activity are rich in sugar or their respiration more intense. It is known, however, from the investigations of W. HENGBERG, that the tubers with a high sugar content are more liable to rot, and that on the other hand tubers with more intense respiration undergo larger reduction of the starch content.

Among the tubers subjected to low temperature, increase in the sugar content occurs in those in which the amylases possess greater activity.

II. — The results by means of which DOBY determined the characteristic properties of amylase in potatoes in the resting state afforded the possibility of continuing enquiries into this question. The experiments were carried out on carefully chosen potatoes from the test fields of the Royal Hungarian Station of Plant Physiology and Pathology. A parallel analysis was made of 11 specimens of healthy and diseased potatoes and of specimens of exclusively diseased potatoes, along 2 lines : it was ascertained what way the proportion of amylase is modified first of all in the potato in state of rest and afterwards in the expressed juice of the tubers and during its storage.

From these researches, it is concluded that a portion of the amylase present in the potato in the form of zymogene which is transformed into an active enzyme towards the end of the resting stage ; this transformation however, takes place much more rapidly if the juice of the tubers is kept in the presence of an antiseptic. FORD and CUTRIE, and also VAN LAER endeavoured to determine the agents which produce this metamorphosis. They immersed the dust of germinating barley in papaine, which increased the activity of the amylase. There is reason to believe therefore that the potato also, the action of the proteolytic enzymes slowly transforms zymogene of the amylase into free enzyme during the winter rest; this transformation is more rapid in the expressed juice after the cell walls have been destroyed, from which it follows that the action of the amylase becomes stronger in the juice antiseptically stored. Up to the middle of the period of rest, however, the quantity of zymogene is small ; it only begins to increase at the beginning of January, and from this time onwards increased activity of the stored juice may be observed. It is well known that the amylase of the potato is extremely sensitive. It follows that the greater the initial activity of the potato juice, the less this activity increases during storage of the juice, that is to say, the more quickly it disappears. When the quantity of enzyme in the juice is small and that of zymogene large, many new enzymes are formed by autolysis from this latter, that a large increase of them is observable, in spite of the weakening and disappearance of the enzymes already present. On the other hand, towards the spring,

antity of zymogene constantly diminishes and that of enzyme increases; consequently the action of the fresh juice will be stronger, but during storage it will no longer increase, and as the intensity of activity depends on continual formation of enzymes by the zymogenes, the weakening of action will be evident. These considerations lead to the following conclusions: the nearer spring approaches, the more the action of the freshly pressed juice of the tubers will gain in intensity; on the other hand, the activity of the juice prepared in winter increases but little during storage, it is maintained for a long time; the activity of the juice prepared later increases rapidly, but is of shorter duration: finally the activity of the juice prepared towards the end of spring shows no increase and becomes less and less lasting.

Other investigations have brought out the fact that the proportion amylase in the potato (in the freshly prepared juice) is dependent neither on the variety nor on the soil, but depends on complex factors the elucidation which requires further research.

The activity of the amylase is almost entirely independent of the size of the tubers.

Finally it was ascertained that, between the tubers of healthy plants and those from plants suffering from leaf curl, there is no correlation in the absolute value of the amylase content; on the other hand, the ratio enzyme to zymogene differs in healthy and in diseased tubers. In the healthy potato there is comparatively more zymogene, and therefore more of it in reserve, than in the diseased ones; the activity of the juice of the healthy tubers is stronger and more constant than that of the diseased tubers. These investigations therefore confirm the observations according to which the leaf of the potato leaf is accompanied, not only by mycological, but also by chemical transformations. These researches likewise refute the thesis MASSEE according to which, the quantity of amylase is less in the selected potato and consequently resistance to disease would be weakened by selection; if this were true, the amylase content in the diseased potatoes should be less. Contrary to this view, however, the observations of the writers agree in their general character with those of DOBY, inferred from the chemical composition of the healthy and diseased tubers, and the ratios of concentration of their oxydases, according to which the proportion of the enzyme hydrolysing starch is not in direct relation to the state of health. These experiments have shown that changes indeed take place but they are so subtle a nature that only minute analyses could make them clear.

Further studies are required to elucidate such questions as to whether the chemico-pathological changes are brought about by pathogenic plant parasites, and to what extent the optimum of amylase and the activation of the latter by foreign substances differ in healthy and in diseased tubers.

852 - Amount of Humic Substances in Decomposing Leaves (Laboratory of Science of Agriculture of the University of Petrograd). — TRUSOV A. C., in *Cesarkoe Xosnitsa u L'ivoborodemno* (Agriculture and Sylviculture), Vol. CCI, year LXXVI, pp. 33-37; Petrograd, March 1916.

Continuing his researches into the humification of the elements which constitute the vegetable organism (1), the writer now communicates the results of his experiments into the quantity of humus soluble in water at dilute ammonia, produced in the leaves of maple and birch in decomposition; the influence of the conditions under which decomposition takes place; a comparison between the two methods of determination of humic substance, namely the colorimetric method and the permanganate of potash method; and the composition of the humic substances extracted from the decomposing leaves; finally he also gives the conclusions drawn on the basis of the experiments.

In these investigations, maple and birch leaves were employed. The maples leaves were chosen on account of their richness in tannic substance which, as is proved by the writer's early work, should play an active part in the formation of humus.

The leaves were taken in September, that is, when already yellow; a number of them were taken from the tree, so as to have a product not far advanced in decomposition, and the rest were gathered from the ground in order to secure the bacterial flora, which, under normal conditions, plays a part in the decomposition of maple leaves. For some days, the leaves gathered were dried at a temperature of 15-17° C., 5 grms by weight were then put into each capsule, and 15 cc. of water added every day for a period of 40 days, in order to keep the conditions of decomposition constantly favourable; after this first period, during the following 60 days, only 10 cc. of water were added, with a view to avoiding excessive moisture, as about one third of the leaves were already decomposed; on the expiry of 100 days only 5 cc. were added. In spite of the addition of this large quantity of water, it may be assumed, in view of the constant temperature of 37° that the decomposition of the leaves takes place under the conditions which it would occur in the case of incomplete water saturation of the leaves, the saturation really only having been complete for a comparative short time in these experiments. In addition to distilled water, the leaves were, in order to allow of inoculation by their respective micro-organisms, wetted occasionally with some drops of water in which leaf decomposed on the ground had been steeped, the said leaves having been taken from the same tree as those used for the experiment.

The decomposition of these latter was carried out in an incubator at a constant temperature of 36-37° C., which was selected in order to hasten the process in question.

The determination of the humic substances was made after 4, 8, 12, 25, 40, 66 and 100 days from the start of the experiment. Each time 4 distillates were taken, two for ascertaining the quantity of dry matter and, al-

(1) See *B.* 1915, Nos. 347, 888 and 1123; *B.* January 1916, No. 11.

rds, the composition of the organic substance of the leaf, and the other for determining the quantity of humic substance soluble in water and ammonia. Two ammoniacal solutions were used, one to determine the humic substance insoluble in water, and the other to estimate the total quantity of this substance. The determinations were made by the two methods, namely the colorimetric method and the permanganate of potash method.

The results furnished by each method were compared, and the accuracy of the colorimetric method in particular was shown; the results of both were to a great degree parallel, but reasons are stated for the preference given to the permanganate method, which enables the work to be done much more easily.

The results of the experiments on maple leaves are combined in the following table.

Quantity of humic substances produced in decomposing maple leaves at constant temperature of 37° C., when these leaves are incompletely impregnated with water.

Number of days after beginning of experiment	Part soluble in water. Per cent.		Part soluble in ammonia. Per cent.		Total percentage soluble in ammonia	
	Relatively to amount of decomposed leaf	Relatively to maximum quantity of humic substance produced	Relatively to amount of decomposed leaf	Relatively to maximum quantity of humic substance produced	Relatively to amount of decomposed leaf	Relatively to maximum quantity of humic substance produced
4	1.16	97.3	1.02	77.0	2.19	86.4
8	1.32	100.0	1.47	100.0	2.79	100.0
12	1.27	96.3	1.23	85.9	2.48	88.8
16	1.07	75.5	1.17	73.8	2.24	73.8
25	1.10	69.5	1.71	97.0	2.81	83.4
40	0.53	32.4	0.90	55.7	1.54	44.3
66	0.64	36.5	0.50	28.7	1.22	32.4
100	0.50	27.4	0.94	77.4	1.48	37.7

Similar results were also obtained with birch leaves, with the difference that the ratio between the proportion of humic substance soluble in water and that soluble in ammonia is not the same as for the maple leaves (being 1 : 1 in the latter case, against 1 : 2 or 3 in the case of the birch leaves). It was ascertained that a more thorough drying of the decomposing leaves entails a reduction in the solubility of the humic matter, and that this is probably the cause of the fluctuations still observed in the table reproduced above.

Conclusions. I.—The content of water-soluble humic substance varies according to the decomposed leaves; for instance, for autumn leaves of the

maple which have just fallen, after 4 days' decomposition this content 1.93 per cent and represents about 50 per cent of the total content of humic substance.

2. — In the course of the gradual decomposition of freshly fallen autumn maple leaves, the quantity of water-soluble humic substance increases at first and then falls off, a contrary phenomenon to what one would *a priori* assume, seeing that the source of the humus is not the whole of the vegetable substance, but only some of its particular constituents. It follows from this that it is during the first period of its decomposition the vegetable residue takes the most active part in the formation of the humus.

3. — The same phenomenon, namely, initial increase followed by subsequent reduction of humic substance, is also disclosed in the case of ammoniacal solutions of this substance. These facts prove clearly that humic substance is chiefly formed during the first brief period of decomposition of vegetable detritus. Then, evidently, this substance itself is partly decomposed and passes partly into other forms of humic combinations.

4. — The ratio between the quantity of water-soluble humic substance and that soluble in ammonia varies with the different leaves undergoing decomposition and the different periods of the process.

5. — The content of humic substance in decomposing leaves depends on the conditions under which decomposition takes place; it declines when repeated desiccation of the leaves occurs and to any considerable extent.

6. — Although the decomposition of the vegetable residue lasted 11 days, the quantity of humic substance formed in the first 8 days was increased, and after 156 days its solubility in water had completely disappeared.

853 - On the Nutrition of Green Plants by means of Organic Substances. — RAVEN CIRIO, in *Atti della Reale Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di scienze fisiche, matematiche e naturali*, Vol. XXV, No. 9, pp. 649-655, figs. 3. Rome, May 7, 1911.

Work carried out in the Laboratory of Agricultural Chemistry of the Royal University of Bologna.

In order to ascertain whether plants can live in darkness, provided organic matter is present in their culture medium, maize plants were grown in a sterilised nutrient solution to which glucose had been added in solutions of 1, 4, 6 and 10 per cent. One plant without glucose was kept as control. They were kept for comparison, some in the light, others in darkness. Their growth was observed and they were examined for the presence or absence of starch in their leaves. It was found that even when the plants are under conditions which enable them to absorb glucose through their roots, no formation of starch takes place in darkness. Further, the most suitable degree of concentration for the glucose seemed to be 1 to 10 per cent.

In order to ascertain whether the plants treated with glucose had produced starch in their leaves, even in the absence of carbonic acid, a plant in nutrient solution with glucose and a control plant were placed in an airtight glass vessel containing a dish filled with caustic potash. So

parts of the plant were covered with strips of black paper. On the following day the starch reaction was tested on some of the leaves, and it was found that the leaves of the plants cultivated in the sugar solution only showed the starch reaction clearly on their parts not covered with black paper, while those of the control plants the reaction was negative.

In order to ascertain whether starch was formed at the expense of the glucose by direct synthesis, or indirectly by a photosynthetic process at the expense of the carbonic acid as a result of its complete oxidation, it was decided to ascertain which part of the solar spectrum might possess most influence on the phenomenon. For this purpose, the previous experiment was repeated, but the colourless glass of the vessel was replaced by blue glass. For control of this experiment, a plant cultivated in a solution of glucose was placed in a glass vessel of a similar colour to the preceding one, but without caustic potash, and carbonic acid introduced. In this plant, as in that of the previous experiment, the starch reaction was negative on some leaves; on others slight traces of colouring were shown.

This suggests that for the formation of starch in plants growing in a sugar solution, the same light rays are essential which are responsible for the chlorophyll function. The reaction obtained with the blue glass was much below that obtained with white light, and was equal to the reaction shown by the control plants kept in the coloured vessel in the presence of carbonic acid.

It was then thought that if, with a plant growing in a sugar solution, the formation of starch takes place in consequence of the complete oxidation of glucose, by removing from the atmosphere not only the carbonic acid but the oxygen as well, the starch would be prevented from forming because glucose could no longer oxidise. A plant grown in a sugar solution was therefore placed in a hydraulically closed bomb containing a full of stick caustic potash and filled with pure nitrogen. The starch reaction was negative. The experiment repeated several times led the same result, although the plants still retained their vitality.

In order to check the preceding experiment, the plant was kept in the bomb without the tube of caustic potash, and in an atmosphere deprived of oxygen, containing in addition to the nitrogen little carbonic acid; the starch reaction was always positive.

The results of these experiments therefore show that :

1) Plants cultivated in glucose solution show the presence of starch in their leaves, even in the absence of carbonic acid, but only in the light;

2) The region of the solar spectrum which is most effective in the formation of starch, under the above conditions, is the same one which is most active in the chlorophyllian function;

3) Plants grown in a sugar solution in an atmosphere free of carbonic acid and oxygen, do not form starch in their leaves even when exposed to light.

The logical conclusion is that the sugar absorbed by the roots is oxidised in the interior of the plant itself by the atmospheric oxygen until carbonic

acid gas is formed, which gives rise in the leaves to the formation of ^{starch}
as a consequence of the chlorophyllian function.

The glucose absorbed is readily oxidised in the plant. This also agrees with the experiments of MOLLIARD (*Comptes Rendus de l' Académie des Sciences*, 141, 389-1905), who, in plants treated with glucose, found a great degree of acidity, which is a sign of the incomplete oxidation of the sugar.

The investigations will be continued, chiefly with substances of the aromatic series, which are also presumed to be energetically oxidised by plant

854 - **The Influence of Boron on Plant Growth.** — I. VOELCKER J. A. [The Wedgwood Experimental Station of the Royal Agricultural Society of England, Pot-Culture Experiments, 1915. (b) The influence of Boron Compounds, on 1) Wheat, 2) Barley], in: *Journal of the Royal Agricultural Society of England*, Vol. LXXXVI, pp. 347-351 — II. COOK F. C. (Physiological Chemist, Bureau of Chemistry, U. S. Dept. of Agric.). *Journal of Agricultural Research*, Vol. V, No. 19, pp. 877-890. Washington D. C., 1916.

I. — Duplicate pot-experiments with boric acid and borax upon wheat and barley; the quantities of the boron compounds used were from 0.05 to 0.10 per cent. of the element as reckoned on the whole content of each pot.

On considering the results obtained the following conclusions may be drawn:

1. Germination is retarded when anything over 0.003 per cent. of boron is used, and even 0.001 per cent., more especially with borax, seems to delay germination.

2. Anything over 0.001 per cent. of boron, either as boric acid or borax, will prevent plants from developing and forming grain.

3. A toxic influence is shown with 0.0005 per cent. of boron, but in quantities not exceeding 0.00025 per cent. there is a slightly stimulant effect.

4. The effects generally are more marked with borax than with boric acid.

II. — The experiments reported were made in connection with a cooperative study of borax and calcined colemanite (1) as larvicides to the house fly (2) conducted by the Bureaux of Entomology, Chemistry, and Plant Industry, of the U. S. Department of Agriculture. The object of the present paper was to determine the effect of boron-treated horse manure on plant growth, and to study the absorption of boron and its distribution in the roots, stems and fruit of plants grown on soil fertilized with this manure and on soil fertilized with untreated manure. The plants (white beets, tomatoes, cowpeas, lettuce, soybeans, potatoes, corn, oats, radish, string beans) were grown in pots in the greenhouses of the Department and on open plots at Arlington Experimental Farm, Va.; Dallas, Tex.; Orlando, Fla.; and New Orleans, La. At least four pots for each treatment were employed in the pot tests; the plots at Arlington were $\frac{1}{20}$ of an acre and the others about $\frac{1}{60}$ of an acre; the tests with lettuce were carried out

(1) Hydrous borate of calcium. Cf. DIANA'S *Manual of Mineralogy*, 13th. ed., 1912. ⁴

(2) See B. 1915, Nos. 64 and 117.

inches, each 3×5 feet. The percentages of boric acid were calculated on a water and ash-free basis.

The general conclusions may be stated as follows:

1. It apparently made little difference in the quantity of boron absorbed by the plants tested whether boron was added to the soil as borax or calcined colemanite. The addition of lime with borax had no definite effect in preventing the absorption of boron. Wheat and oats absorbed very little boron, while leguminous and succulent plants absorbed comparatively large amounts.
2. Wheat, beets, cowpeas, and tomatoes grown in pots in the greenhouse contained boron principally in the tops of the plants, and, with the exception of the beets, comparatively little or none in the roots.
3. The fruit of the tomato plants contained only traces of boron, while the fruit of the cowpea contained large quantities. Lettuce grown in the greenhouse absorbed boron in proportion to the amounts present in the soil.
4. Potatoes grown in the open showed, when mature, a small amount of boron in the tops and relatively large amounts in the roots and tubers.
5. The leguminous plants, string beans, soybeans, and cowpeas, which were very sensitive to boron, showed, when grown in plot tests, a more equal distribution of the boron among the roots, tops, and fruit than other plants tested.
6. Radishes grown in plots contained much larger quantities of boron in the tops than in the roots. Analyses of entire plants of wheat, corn, and oats grown on plots in the South showed absorption of boron in all cases, the peas absorbing the most. All of the control plants contained at least a trace of boron.
7. Samples of soil from some of the control plots showed the presence of acid-soluble boron, while several similar samples of soil from certain boron-treated plots showed no acid-soluble boron. Usually more soluble boron was found in the treated soil than in the control soil.
8. The yield of wheat from a plot heavily treated with borax was 90 per cent. of the manured-control yield and was greater than the yield from the unmanured control. The wheat grains were sound and contained but little boron.
9. The yield of tomatoes in pot tests was unaffected when borax was added in amounts giving 0.0018 per cent. of boron in the soil, but when the amount was increased to 0.0030 per cent., a reduced yield resulted.
10. Numerous factors influence the absorption, distribution and action of boron in plants.
11. Not more than 0.82 pound of borax or 0.75 pound of calcined colemanite should be added to each 10 cubic feet of manure, and when using boron-treated manure in growing leguminous plants, the manure should be mixed with untreated manure before being applied to the soil. For other plants, boron-treated manure should not be used at a higher rate than 1 ton per acre. Fourteen references are quoted in the bibliography (1).

¹ See *B.*, Jan. 1911, No. 38, and *B.*, May, 1913, No. 483.

855 - **The Influence of Strontium Salts on Wheat** (The Woburn Experimental Station of the Royal Agricultural Society of England, Pot-Culture Experiments, 1915, I. Th Hill's Experiments, a). — VOELCKER J. A. in *The Journal of the Royal Agricultural Society of England*, Vol. LXXVI, pp. 344-346 + pl. 1-2. London, 1915.

Little being known about the action of strontium on plants, duplicate pot-experiments were made with sulphate, nitrate, hydrate, chloride, and carbonate of strontium; the salts were applied in quantities supplying the element of strontium in two different amounts, namely, 0.05 per cent and 0.10 per cent, reckoned on the whole of the soil used. The soil was of light and by no means rich character, and twelve seeds of wheat were sown in each pot on November, 1914; the crops were cut in August, 1915.

The results are summarised as follows :

1. Strontium in the form of the sulphate, hydrate, and carbonate is, when given up to 0.10 per cent., practically without effect either on the germination of the seed or the increase of the crop.

2. Strontium used as strontium nitrate produces an increase in crop, but this cannot be attributed to the presence of strontium.

3. Strontium applied as strontium chloride has a retarding effect on germination, and when used in quantity approaching 0.10 per cent. of strontium, has a distinctly toxic effect.

856 - **Experiments in connection with the Assimilation of Potassium and Sodium Ions by the Sugar Beet.** — STOKLASA JULIUS, in *Biochemische Zeitschrift*, Vol. 73, No. 3 and 4, pp. 360-372. Berlin, March 21, 1916.

A discussion of the experiments of other scientists is followed by a description of those of the writer; the object of the latter was to determine:

a) The value of potassium chloride and sodium chloride in the production of substance in the root of the beet;

b) Why calcareous soils promote assimilation of potash by the beet and increase the weight and sugar content of the root;

c) The behaviour of calcium chloride in the presence of potassium chloride and sodium chloride;

d) The influence of sodium and potassium chlorides on the development of the sugar beet in the different periods of growth.

For this purpose sugar beets "Wohntas Zuckerréiche" (Wohntas variety rich in sugar) were planted, one in each pot containing 18 kg of earth manured with different doses of salts. During these experiments divided into 5 series, the following facts were observed :

1) potassium chloride and sodium chloride increase both the weight of the root and its content of sugar if used separately in a decinormal solution. The potassium ion produces a greater increase than the sodium so that it is really possible to attribute a specific action to it.

2) A stronger concentration of the sodium chloride ($\frac{3}{10}$ N.) results a reduction of weight and sugar content in the root. In this concentration potassium chloride also fails to promote the growth of the plant. A stronger concentration of potassium chloride ($\frac{3}{10}$ N.) reduces the percentage of dry matter in the root, and consequently the total quantity of sugar formed.

but the percentage of sugar in the root is not changed to any marked extent.

3) An increase of the dry substance and the sugar content is secured administering sodium chloride and potassium chloride together. A biologically balanced salt solution, in which the toxic action of the two salts is mutually neutralised, then forms in the soil. To neutralise the toxic properties of a $\frac{3}{10}$ N. solution of potassium chloride only a $\frac{2}{10}$ N. solution of sodium chloride is needed.

4) Calcium carbonate employed in a $\frac{3}{10}$ N. solution in the presence of corresponding quantities of potassium chloride and sodium chloride not only acts favourably on the growth of the root and its sugar content, but is also able to counteract the toxic effect of abnormal quantities of potassium chloride or sodium chloride administered either separately or together. The maximum production of dry substance and sugar is obtained by using the three salts (KCl , $NaCl$, and $CaCO_3$) together. Calcium carbonate especially promotes the growth of the root.

5) The toxic effect of potassium chloride and sodium chloride is counteracted by calcium chloride, but this phenomenon affects rather the content of sugar than the quantity of dry substance. The maximum sugar production was obtained by using the three chlorides together.

6) Sodium chloride and potassium chloride do not promote the growth of plants during the first 2 periods of development (after 27 and 57 days respectively), if used separately; but if employed together, the production of dry matter increases. In the 3rd period of growth (after 76 days), when beet is at a more advanced age, the effect of potassium chloride far exceeds that of sodium chloride. On using both salts together, the increase in production in the third period is not equal to that in the 1st and 2nd period of growth.

7) The anatomical changes in the plants are highly characteristic. Potassium chloride and sodium chloride are not used together in the 2nd period of vegetation. Potassium chloride produces well developed, firm leaves, fairly fine, not very curly, having a leaf stalk rich in chlorophyll, while sodium chloride results in softer leaves, with a fair amount of curl, with leaf stalks reddish at the base.

The potassium ion therefore has a great influence on the firm consistency of the leaves and promotes the formation of chlorophyll, thus forming an important factor in the process of assimilation.

The sodium ion appears to influence the growth of the epidermis of the plant and to a less extent the process of assimilation.

It was also determined in what measure the potassium ion and the sodium ion were assimilated by the beet plant. The following were the results obtained:

(A) The assimilation was at its maximum when the two chlorides were together in the soil in a $\frac{1}{10}$ N. solution, and at its minimum when sodium chloride alone was in the soil.

(B) In those cases where the soil contained either sodium chloride or potassium chloride or both together, in different concentrations, 4.16 grms

of K₂O were required, on the average, for the production of 100 grms, saccharose.

(C) The quantity of sodium ions assimilated is related to the quantity of potassium ions, but, according to the analyses made, this relation varies very much.

PLANT
REEDING

857 — "Thule", a Variety of Wheat suited to Central Sweden. — NILSSON-ERIKSSON.
Steriges Utsadeljärnens Tidsskrift, XXVth Year, Part I, pp. 5-23. Malmö, 1916.

During the period 1889-1913 wheat growing in Sweden increased at most twofold, thanks chiefly to the selection work carried out at the experimental Station of Svalöf, for the purpose of combining in a single variety the "high productive character of the best types with the "cold resistance" character of the native Swedish wheat.

The increased productivity of grain however was anything but uniform. From a maximum of 200 per cent in the districts of Hallands, Malmöhus and Kristiastads, and generally throughout Southern Sweden (Scania), a minimum of 20 to 30 per cent is reached in the central provinces (Svealand). What is the reason of this? In Scania, during the period 1889-1913, the native wheat was gradually replaced by more productive kinds, while the area sown also increased. On the other hand in Svealand this substitution was only possible within very narrow limits, chiefly owing to the special climatic conditions, which involved very cold winters and long periods of drought in summer. For the wheats to be cultivated in the central provinces, therefore sufficient cold-resisting powers and earliness are required to ensure normal ripening and a good yield of grain. These circumstances render the work of hybridisation and selection very difficult, as it is necessary to exclude some of the types which, though among the best point of yield, are not sufficiently resistant to low temperatures. On the other hand, the increase of the area under wheat in Svealand, the greater quality of the soil and the conditions of the agricultural environment, which are as favourable as possible, fully justify all the investigations and work which have for their object the creation of types better adapted to the climate, and at the same time having a high cropping power.

From 1904 onwards the writer has been working at the following problems; 1) the improvement of local native types by selection; 2) creation of new kinds by crossing with the native form; among these crosses the results were obtained by hybridising the native with the "Pudel"; and afterwards, by perfecting the resulting products by continuous work of selection a new variety was fixed, *Thule I*, presenting the following scheme of characters:

	Pudel	Thule	Native
Productivity	-	+	-
Resistance to cold	-	(+)	+
Resistance to rust	+	(+)	-
Rigidity of culm	-	+	-
Earliness	-	(+)	+
Quality of grain	-	(+)	+

As will be seen, *Thule I* represents a combination superior as regards traits to that of each of the parents. In productivity (3943 lbs. per acre) it is nearly equal to the "Pudel" (3930 lbs per acre), but is considerably superior to it in earliness and cold resistance, as was ascertained particularly during the winter of 1912-1913, when the sowings were very much injured by the low temperatures.

Thule II, resulting from the same cross and isolated by the writer at Svalöf, is still earlier. It is as early as the native type and is more productive than *Thule I*. These two kinds are distinguished from the native Swedish wheats by their high resistance to rust. There is consequently no doubt that the *Thule* wheat is superior to all others hitherto tested in Svealand, where it may be introduced with the certainty of success.

As regards improvement of the native varieties by direct selection, the line U750 (of Latorpshyvete) from Svalöf was cultivated for 3 years at Västra. It is distinguished by its higher cropping power, and could perhaps furnish good material for crosses.

Although the *Thule* wheat is very resistant to cold, it still remains inferior to the native types; it must therefore be improved in this direction. In this object from 1913 onwards, a series of hybridisation trials were undertaken of *Thule I* and *Thule II* with the Swedish native wheat; the preliminary results hitherto obtained fully justify the method adopted and hold out the best prospects.

- Experiments on the Germination Capacity of Beet Seeds in Bohemia.—I. URBAN J. and VITĚK E., Influence of very low temperatures on the germination capacity of beet seeds, in *Zeitschrift für Zuckerindustrie in Böhmen*, 40th year, No. 7, pp. 29-300, tables, Prague, April 1916. — II. VITĚK E., Investigations on the mode of determining the germinating capacity in beet seed. *Ibid.* No. 8, pp. 363-381, tables, May 1916.

I. — *Influence of low temperature on the germination capacity.* In a first experiment, 100 grms of thoroughly ripe dried seeds were divided into 2 groups, one of which was exposed for half an hour to the low temperature produced by liquid air allowed to evaporate spontaneously.

In the 2 groups of seeds, the germination capacity was next ascertained by placing them on blotting paper in a thermostat with a temperature varying from 20 to 30° C.

As early as 3 days later, it was found that the vitality of the seeds subjected previously to a temperature of -180° C. had not diminished. Fifteen days later, 95 per cent of the non-frozen fruits and 96 per cent of the fruits exposed to the liquid air had germinated. It is evident from this experiment that the strongest frosts do not impair the germination capacity of seeds with normal water content.

In a 2nd experiment, the object was to study the behaviour of seeds harvested in wet weather. For this purpose 4 samples of seeds were used, containing about 20 per cent of water when harvested. The seeds of each sample were divided into 3 groups equal in weight and volume, each containing 100 fruits, and for each sample one of these groups was placed in liquid air; 3 groups remained in it for 2 hours, and one group from 6 to 8 hours.

From the results summarised in the table it is evident that the seeds had, generally speaking, germinated badly, but that freezing for 72 hours had not affected their germination capacity. This experiment therefore proves that it is needless to protect seeds kept dry against frost, as frost only impairs the germination capacity when the seed contains an abnormal (excessively high) percentage of water. It may also be concluded that by drying the seeds artificially not only is their keeping power increased, but their germination capacity is maintained, especially if the seed was wet at the time when harvested.

II. — *Investigations on the mode of determining the germination capacity.* While the method now employed for determining the purity of beet seeds gives fairly accurate and concordant results, the determination of the germination capacity hitherto has remained rather defective as is shown by the relatively large differences in the results of experiments. It was consequently proposed to study this latter question, endeavouring in particular to ascertain whether, for determining the germination capacity, blotting paper or sand gives the best results. Among the samples studied in 1913 by the seed test Station of the "Landeskulturat" of Bohemia, 26 typical samples were chosen for comparative determination of the germination capacity on blotting paper and on sand, always using 100 fruits of each kind in 3 sets of experiments.

It results that blotting paper is better than sand. In 20 samples on blotting paper (77 per cent. of the cases) the germination capacity was better than on sand; in 9 samples the number of germinated seeds exceeded that of the samples on sand by 1 to 5 per cent; in 10 samples the percentage was 6 to 10 per cent., and in 1 sample 11 to 13 per cent. The same germination capacity on paper and on sand was observed in 2 samples (8 per cent. of the cases), while the germination capacity was only greater on sand than on paper in 4 samples (15 per cent. of the cases).

The results speak still more clearly in favour of the paper on considering the number of germs. Among the 26 samples studied, 23 (88 per cent. of the cases) gave a larger number of embryos on blotting paper than on sand and only in 3 samples (12 per cent. of the cases) did the fruits give a larger number of embryos on sand.

Analogous results were obtained in 1914.

It is concluded from these experiments that determination of the germination capacity on paper gives better results than on sand; it is therefore recommended that test Stations should discontinue the sand method in favour of the blotting paper method.

CEREALS

859 — **The Wheats of the State of Washington, U. S. A.** — SCHAFER E. G. and GAINES E. F.
in *State College of Washington, Agricultural Experiment Station, Pullman Washington Bulletin*, No. 121, 16 pp., 2 fig. Pullman, Wa., February 1915.

In the State of Washington, many kinds of wheat are cultivated, mostly introduced into that region, but partly native, and resulting from the different conditions of environment in the various parts of the State. Mixing the different wheats in the fields or on the markets causes a reduction in price, and it is therefore desirable that the number should be limited and

only the best ones should be cultivated in the different parts of the State. The writers describe some of the most important varieties, namely:

- 1) *Bluestem*, grown largely in the highest parts as spring wheat, sometimes even as winter wheat;
- 2) *Red Russian*, the winter wheat most widely grown in the region of Palouse, ripening late and resistant to weeds;
- 3) *Hybrid 143*, produced by Prof. W. J. SPILLMAN at the scientific agricultural Station of the State of Washington by crossing White Track and Little Club; high cropping power; may be either spring or autumn sown;
- 4) *Jones Winter Fife*, the chief winter wheat in the driest part of the State;
- 5) *Turkey Red*, the only bearded winter wheat grown in the State of Washington; yields a good hard grain; not much cultivated;
- 6) *Winter Bluestem*, winter wheat obtained by crossing Turkey and Bluestem, combining the cold resistant powers of the former with the ear and grain characteristics of the latter;
- 7) *Forty Fold* (also called *Gold Coin*), the earliest wheat grown in the Palouse region.
- 8) *Marquis*, recently introduced from Canada, a very early spring wheat;
- 9) *Triplet*, a new composite hybrid, not yet distributed to farmers;

Analyses of Wheat in the State of Washington.

VARIETY	Flour per cent.	Dry gluten per cent.	Nitrogen per cent.	Average quality value
Hybrid 128	78.12	10.2	2.125	114.8
Hybrid 143	76.50	13.0	2.120	107.8
Red Russian	82.00	10.0	1.755	93.0
Hybrid 123	77.60	13.0	1.755	104.4
Forty Fold	77.11	13.3	2.015	106.6
Jones Winter Fife	80.05	9.0	1.850	93.5
Little Club	78.32	10.0	1.840	93.4
Hybrid 108	76.93	9.7	1.805	92.2
Turkey Red	78.34	14.3	2.185	111.7
Winter Bluestem	80.73	10.0	2.140	97.5
Triplet	78.20	11.0	2.050	98.5
Hybrid 60	81.00	11.7	1.615	94.5
Hybrid 150	76.32	8.2	1.725	86.2
Bluestem*	81.07	10.0	2.005	95.0
Marquis*	73.05	14.2	2.190	108.0
Red Chai*	81.20	10.2	2.030	96.0
Little Club*	76.02	11.2	2.180	102.3
Hybrid 143	78.02	10.1	1.960	100.2
Averages	79.5	11.0	2.050	—

* Grown as spring wheats.

to) *Hybrid 128*, produced in 1899 by PROF. SPILLMAN, from a cross between Jones Winter Fife and Little Club; high crop yield and good quality; stiff straw; does not shatter.

11) *Little Club*;

12) and 13) *Hybrids* 123 and 108, originating from a cross between Jones Winter Fife and Little Club;

14) and 15) *Hybrids* 150 and 63, Cross Turkey Red \times Little Club; the latter, highly resistant to drought, is rapidly increasing in popularity as a winter wheat;

16-19) *Red Allen, White Elliot, Sonora and Jenkins Club*, spring wheats not much grown, of no great value.

The above winter wheats, cultivated at the Pullman Station of scientific agriculture in 1911, 1912 and 1914, yielded as an average of the three crops from 35.1 bushels (Hybrid 108) to 43.8 bushels per acre (Hybrid 128). Triplet, cultivated only in 1914, gave 53.9 bushels per acre. If the average unit crop produced in a field be taken as 100 for all the wheats tested (with the exception of Triplet), Hybrid 128 gives 105; Winter Bluestem 104; Hybrid 60, 102; Red Russian and Little Club 101; the minimum crops were: Forty Fold 89 and Hybrid 108, 84. The percentages differ somewhat, but generally the order of merit remains the same if the results obtained on small test plots are considered. In both instances, Hybrid 108 ranked last.

The analyses of wheats grown on plots in 1914 under uniform conditions gave the results set out in the accompanying table. The last column was calculated in the following way: taking the value of the average of each of the vertical columns as equal to 100, the percentage of flour, gluten and nitrogen was recalculated for each variety, and it was assumed that the average of these three percentages represents the percentage which expresses the quality value.

860 - Injuries to Rye and Wheat Grain produced by Threshing, and their Consequences.

—WALDEN J. N., in *Sveriges Utsädeförening Tidskrift*, XXVith Year, Part 1, pp. 24-47. 8 tables, 2 figs. Malmö, 1916.

Experiments carried out by the writer prove that the injury caused to grain by threshing, even if very slight, reduces the vitality of the grain, rendering it very sensitive to the action of copper sulphate used for seed disinfection. This sensitiveness is found especially in grain put through ordinary threshing machines. It decreases on the other hand when a small special threshing machine is used, as at Svalöf, and it completely disappears in grains husked by hand. In the latter case, the germination capacity of the grains is not even affected by the use of 10-25 % solutions of copper sulphate.

By means of a new method, of which a description is given later, it was possible to ascertain accurately the location and extent of the injuries in a very large number of grains of different origins. The grain is thus divided into 3 classes: (a) grain without injury; (b) with light injury; (c) with severe injury. The sensitiveness of the grain in relation to formalin and copper sulphate varies considerably for the 3 categories, as may be seen from Table I.

The injuries produced by threshing also considerably affect the keeping properties of the grain, particularly when the latter has a large content of water and is exposed to high temperatures. Thus, for recently cropped

TABLE I. — Sensitiveness of injured or uninjured grain to formalin and copper sulphate.

Varieties	Extent of injury	Germination capacity											
		Untreated grain				Grain treated with a 3 % solution of formalin				Grain treated with a 2 % solution of copper sulphate			
		germinated %	not germinated %	dead %	germinated %	not germinated %	dead %	germinated %	not germinated %	dead %	germinated %	not germinated %	dead %
rat « Thule »	0	100	0	0	58	3	39	65	21	4	10	—	—
	1/2	92	8	0	79	0	21	67	26	5	2	—	—
	1/4	79	21	0	94	4	2	89	2	9	0	—	—
rat « Väperl »	0	100	—	—	—	—	—	2	54	0	44	—	—
	1/2	100	—	—	—	—	—	9	67	0	24	—	—
	1/4	—	—	—	—	—	—	42	54	0	4	—	—
	0	—	—	—	—	—	—	84	16	0	0	—	—

TABLE II. — Reduction of germination capacity sustained in 2 weeks by injured rye grains.

Varieties	Percentage of grains in each class of injury	Germination capacity of grains	Germination capacity in each class of injury				Percentage of dead grains in each class of injury	Moisture %
			0	1/4	1/2	1		
rat « Stora N. 40 »	0	51.0 45.5 3.5	98.0 —	99.0 95.5	71.5 —	1.0 4.5 18.5 19.5	—	—
“ ” “ 7 ”	0	38.5 46.0 15.5	84.0 —	97.5 87.5	35.5 —	2.5 22.5 64.5 19.5	—	—
“ ” “ 19 ”	0	0 73.0 25.0	74.0 —	— 68.0	36.0 —	— 32.0 64.0 19.3	—	—
“ ” “ 30 ”	0	22.5 71.5 6.0	100.0 —	100.0 98.0	100.0 —	0 2.0 — 15.0	—	—
rat « Midvadmar »	0	14.0 63.0 13.0	72.0 —	93.0 79.5	61.0 —	7.0 20.5 39.0 20.0	—	—

the badly damaged grain loses a great portion of its germination capacity 1-2 weeks (cf. Table II).

The same observations have been made for wheat by testing machine threshed and hand-husked grain.

The method contrived by the writer for rapidly ascertaining the extent of the injuries sustained consist in submerging the grains to be examined in an 0.4 % solution of eosin, and afterwards washing them in water. Where there is a break in the continuity of the integument, the eosin is absorbed, and communicates a conspicuous red hue to the injured portion. For grading the extent of the injury the following scale has been adopted : 0, no

visible or very slight colouring: $\frac{1}{4}$, colouring at end; $\frac{1}{2}$, one half at least of the surface of the embryo is strongly coloured; $\frac{1}{4}$ the entire surface of the embryo is strongly coloured. This very simple system allows the farmer to determine with sufficient accuracy to what extent the injury produced by threshing can impair the germination faculty and the keeping property of grain.

861 — Cultural, Food and Industrial Value of some Varieties of Potato tested in Hungary.

— SZELL L. (Chair of Chemistry and Technology of the Royal Hungarian Agricultural Academy at Debrecen), in *Kísérletiügyi Közlemények* (Bulletin of Hungarian Scientific Agricultural Stations), Vol. XVIII, Part 3, pp. 659-666, tables. Budapest, 1915.

Experiments carried out in 1914 on the test fields of the agricultural Academy at Debrecen, with the 6 varieties of potato — Up to Date Richter Imperator, Silesia, Böhms' Erfolg, Jubel and Record — planted after autumn rye, in compact sandy soil at about $19\frac{1}{2}$ ins apart. The varieties Jubel, Record, Böhms' Erfolg and Silesia were greenmannured in the autumn, and in the spring given a dressing of 232 lbs. of superphosphate and 155 lbs. of potash salts (40 %) per acre; Up to Date and Imperator received only green manure. The monthly rainfall and average daily temperatures varied as follows from the beginning of April to the end of October.

	Rainfall		Temperatures		Rainfall		Temperatures	
	April	May	July	August	September	October	July	August
April	17.1 mm		11.6°C				80.5 mm	21.5°C
May		32.4	11.6					19.9
June		110.6	18.4				61.8	13.3
							70.6	9.1

Particulars with regard to time of plantation and crop, and also content of starch and dry substance, are contained in Table I,

Table I. — *Yields of the Different Varieties.*

Varieties	Plantation	Crop	Yield of tubers			Average content		Yield of starch	
			Date of:			of:		and dry matter	
			cwts per acre	2nd class	1st class	Starch	Dry	cwts per acre	Dry
				small	large and medium tubers	Total	matter		matter
Up to date	16 IV	19 X	79.93	15.91	95.84	20.0 %	25.8 %	19.17	24.53
Imperator	*	19 X	99.38	38.33	137.71	19.8	25.6	27.26	31.55
Jubel	*	8 IX	105.54	78.41	183.98	20.7	26.5	36.67	46.95
Record	*	8 X	90.88	53.13	144.03	21.8	27.6	34.38	39.73
Böhms' Erfolg	*	9 X	105.73	85.26	190.99	20.8	26.6	40.68	52.28
Silesia	*	9 X	91.30	96.33	187.68	20.7	26.5	38.81	40.53

The Record variety leads in regard to starch content. Next follow in order of importance: Böhm's Erfolg, Jubel, Silesia, Up to date and Imperator. For yield of starch per unit of area the first place is taken by Böhm's Erfolg, followed by Silesia, Jubel, Record, Imperator and Up to Date.

Among the 3 different sizes of tubers (large, medium, small) of the same variety, the maximum difference in the starch content was 5.3 % (Up to Date) and the minimum 0.7 % (Record). The starch content of the small tubers was much below that of the large. On the other hand, the difference between the starch content of the large tubers and that of the medium was small (these particulars are combined in a table).

In order to ascertain the cooking qualities, the following method was used: After marking all the varieties with a pin, some tubers of similar shape were put into a pot, covered with cold water and slowly cooked on an electric stove, the water not reaching the boiling point until 2 1/2 hours had expired. During boiling the potatoes were tested at intervals by means of an iron wire 2 mm. in diameter. They were regarded as cooked when the iron wire passed through 2 tubers at once under a slight pressure, and when, on being cut open they showed all the properties of normally cooked potatoes. The roasting quality was determined as follows: 5 equal tubers of each kind marked were placed in an oven heated to 100° C., the temperature of which was afterwards raised during one hour to 150° C. and kept at this until the end of the tests; the potatoes taken out from the oven were regarded as thoroughly roasted when the iron wire passed through the tuber easily and divided it into two halves, the latter then showing all the properties of a well roasted potato.

TABLE II. — *Cooking Qualities of the Different Varieties.*

Varieties	Classification of hardness compared with raw state	Boiling capacity			Roast- ing quality	Taste	Substance
		Temperature maximum	Number of minutes required for boiling	Number of minutes after which tubers crack			
Up to date . . .	1 max	87° C	68	70	83	excellent	very fine, floury
Imperator	2	87°.5	71	81	105	fairly good	fine, *
Jubel	5 min.	88°	74	79	137	very good	very fine, *
Record	3	91°	101	92	105	good	fair, *
Böhm's Erfolg . .	2	89°	87	106	150	fair	fair, *
Silesia	4	90°	94	117	86	unsatisfactory	fair, waxy.

The comparative method adopted for determining the cooking qualities and flavour of potatoes made it clear, as seen from Table II, that the "Up to Date" variety was superior to the others, being the best for human food, after which come the varieties Jubel, Imperator and Record, which may be used for human food; the sorts Böhm's Erfolg and Silesia, being unsuitable for food purposes, must be classed among potatoes which can be used for industrial objects.

862 - *Influence of Excess of Water in the Soil during the Second Half of the Summer, on the Formation of Secondary Potato Tubers and their Starch Content.* — ARKHAN-
GELSKIJ M. in *Сельское Хозяйство и Лесоводство* (Agriculture and Sylviculture), Vol. CCL, LXXVIIth Year, pp. 400-406. Petrograd, March 1916.

The formation of secondary tubers of the potato (excrescences of the tuber) is a phenomenon which often occurs, according to Prof. FRUWIRTH, in those years when excessive humidity of the soil follows a period of drought at the moment when, in normal years, ripening of the tubers takes place. Having observed this phenomenon in different varieties of potato, in his experiments conducted in 1914 and 1915 at the agricultural experiment Station of Tambov (Russia), the writer desired to clear up 2 further points of the question: 1) how does the formation of secondary tubers affect their starch content? — 2) how do the different varieties behave in reference to the phenomenon studied, that is to say, what is the proportion of tubers with secondary growths in the different varieties?

The tubers planted on 1914 and 1915 were grown from varieties bought in 1913 in one of the best known farms in the government of Riazan. The following is a summary of the most important results of the experiments carried out.

I. — *Influence of Humidity.* — From the weather records it is evident that during the first half of the summer, that is until the middle of July, the rainfall and consequently the amount of moisture in the soil were normal both in 1914 and 1915. On the 20th, 21st and 22nd July 1914 and the 14th July 1915, however, there were such heavy falls of rain that they exceeded the quantity which had fallen in 2 months in the previous years; and others followed, so much so that the moisture of the soil reached a very high degree. After the crop it was found that the tubers of all the potatoes exhibited excrescences from the body of the tuber. Such excrescences occurred in two forms: 1) a shrinkage occurred separating the oldest part of the tuber covered with the rough skin from the newest part with a fine glossy and easily detached skin; 2) or a crop of secondary tubers formed, small and arranged in various ways on the principal tuber, being very easily detached therefrom.

II. — *Behaviour of the Different Varieties of Potatoes with regard to the Excrescences.* — A detailed analysis of the crop led to the conclusion that the different varieties experimented on did not all produce the same proportion of malformed tubers, *i. e.* tubers with excrescences. In order to determine this difference more accurately, the percentage of malformed tubers for each kind was calculated from their number in a given quantity of potatoes. In 1915 these data were completed by also estimating the percentage

TABLE I. — *Formation of Excrescences on the Tubers
in the Different Varieties of Potato.*

Names of varieties	Percentage of deformed tubers in relation:		
	to the total number of tubers tested		to the total weight of tubers tested in 1915
	In 1914	In 1915	
<i>Kitchen Garden:</i>			
local white	65.4	70.3	76.2
Gongated Royal	39.3	39.6	39.5
"Folia"	—	28.6	35.9
"Delicatesse"	29.5	28.5	33.3
rose de neige	—	25.0	32.7
Duchess of Cornwall	—	25.0	31.9
local red	12.0	21.5	28.4
Ever good	19.0	15.2	18.1
<i>Kitchen Garden and Industrial:</i>			
abel	65.9	45.0	56.0
rof. Woltmann	35.2	34.8	36.2
rof. Macrcker	63.2	25.3	29.5
last	47.9	23.7	32.1
eon	37.6	18.2	26.2
switez N. rot	6.6	9.8	12.3
Devant le front"	3.1	8.9	9.3
<i>Industrial:</i>			
ichter's Jubilee	43.3	52.0	63.8
lohol with violet flowers	76.6	40.5	53.4
rocken	20.5	32.0	31.4
ince Bismarck	17.3	21.8	13.7
tif	18.4	20.0	26.1
lesia	36.1	17.7	24.4
ew Emperor	18.8	14.1	16.5
is	6.1	6.3	10.8
<i>mag:</i>			
bite Elephant	50.5	42.7	56.5
he Giant	20.0	20.5	25.4

of malformed tubers relatively to the weight. The results of these determinations are summed up in Table I, where in each group the varieties are in decreasing order of the proportion of malformed tubers.

The figures given in Table I and the other observations made on the cultivations in question lead the writer to suppose that the capacity of resistance to the formation of excrescences is a property of race, which can be fixed by selection, and tests in other localities and on other varieties would be highly desirable in view of the economic importance of the potato.

III. — *Loss of Starch due to Excrescences.* — The determination of the percentage of starch by means of the REIMANN balance showed marked differences between the malformed tubers and those of regular shape.

Table II sums up the particulars in reference to the industrial varieties, the varieties being arranged in decreasing order of the losses of starch sustained.

TABLE II — *Losses of Starch due to Tuber excrescences in Industrial Varieties*

Varieties	Loss of starch	Varieties	Loss of starch
"Devant le front"	4.3 %	Brocken	1.4 %
Silesia	3.9	Grif	1.4
Sas	2.8	Richter's Jubilee . .	1.1
Ever good	2.6	Prof. Wohltmann .	0.4
Prince Bismarck	2.2	New Emperor . . .	0.2

863 — **Comparison between the Effects of Manuring Potatoes with Nitrate of Soda and Sulphate of Ammonia** (From the Agricultural Experiment Station of Radomysl, Russia. — ZASLUHN A., in *Xoziemstvo* (The Farm), XIth Year, No. 17-18, pp. 297-304. Kiev, May 1916.

Experiments carried out at the Agricultural Experiment Station of Radomysl in sandy soil, *i. e.* poor in nitrogen, and for which nitrogenous manure is of great importance. Two nitrogenous manures were studied: nitrate of soda and sulphate of ammonia. The trials made with the latter manure are particularly important because, owing to the present war, the importation of nitrate of soda into Russia has greatly diminished, while large stocks of sulphate of ammonia have accumulated, and the extensive use of the latter in agriculture is imperative.

In order to make this comparison between the effects of nitrate of soda and those of sulphate of ammonia, the manure was used in two different ways: sown directly on the tubers during planting or spread before this operation. In addition, nitrogen was given to one plot, half in the form of sulphate of ammonia before planting and the other half in the form of nitrate of soda during planting. The manure was put down in this latter way in order to allow for the facts indicated in the literature of the subject as to the injury caused by sulphate of ammonia, as an acid salt, and as to the retention of nitrate of soda by the soil. By applying the sulphate of ammonia to the soil, before plantation, it was desired to combine the most favourable conditions for the utilisation of this manure, as the plant was thus enabled to offer a better defence against its injurious action. By

ting the nitrate of soda on the tuber itself, it was meant to make its fixation more immediate and thus prevent its being washed away.

In these tests each plot had received per acre 54 lbs of P_2O_5 in the form of slag and 40 lbs of K_2O in the form of a potash salt. A control plot was t without nitrogenous manure. To all the other plots manure was given equal quantities, i. e. 396 lbs of nitrate of soda or 264 lbs of sulphate of ammonia. During the experiments not only was a determination of the op yield made, but many observations on the growth of the plants were tried out. At the end of May the number of germinated plants was calculated, and then every 10 days the height of the aerial parts of the plant as measured. In addition, at the end of the field, from each plot 10 plants were taken, and there were determined: 1) the quantity and weight of the tubers; 2) the quantity and weight of the stalks of each plant; 3) the weight the aerial parts of each.

The most important results of these experiments are summed up in the appended Table.

Results of Experiments.

Manures used in addition to 54 lbs. of P_2O_5 as slag and 44 lbs. of K_2O as potash salts	Yield of tubers cwt. per acre	Excess due to the addition of nitrogenous manure cwt. per acre
None	46.22	—
Nitrate of soda, 161 lbs., sown	73.09	25.94
Nitrate of soda, 161 lbs., on the tubers	75.39	28.24
Sulphate of ammonia, 107 lbs., sown	79.02	30.875
Sulphate of ammonia, 107 lbs., on the tubers	85.10	38.25
Nitrate of soda, 80 lbs., on the tubers	76.49	29.34
Sulphate of ammonia, 54 lbs., sown		

The comparison between the figures of the Table and the observations de points to the following conclusions:

- 1) Sulphate of ammonia gave a larger yield as compared with nitrate of soda.
- 2) A bigger crop was obtained by applying sulphate of ammonia to the tuber than by spreading it before planting.
- 3) By applying the dressing of nitrate of soda to the tuber, the development of the potato in its first period of growth was considerably retarded. As regards the crop, it appears nearly equal, whether the nitrate of soda is applied to the tuber or is spread before planting.
- 4) By giving half of the nitrogen in the form of nitrate of soda to the tuber, and the other half in the form of sulphate of ammonia to the soil

where it is spread before sowing, no advantage was secured as compared with manuring the potato with sulphate of ammonia alone.

For a more accurate interpretation of the results of these tests, it should not be forgotten that the spring and the first half of the summer were very dry.

ROPS
ING OILS,
DYES
TANNINS

864 - Wild Oil Plants of Para, Brazil. — *Chacaras e Quintas*, Vol. XIII, No. 5, pp. 322-323.
S. Paulo, May 15, 1916.

MR. C. PESCE, of Cametá, Para, Brazil, has for several years been studying the oil seeds of the forests and islands in the estuary of the Amazon. He reports the following species, which he uses in his factory of vegetable oils and soaps, and of which he exports part to Europe. This list proves that Para is exceptionally rich in wild oil plants.

Carapa procera (=*C. guyanensis*) ("andiroba"); its fruit furnishes an oil used in the manufacture of soap, lubrication and lighting oils, but as it contains a bitter principle it is not edible.

Myristica (Virola) Bicuhyba ("ucuhuba") furnishes a very thick tallow containing a large proportion of stearin, suitable for the manufacture of soap and candles, and, after purification, for food.

Astrocaryum vulgare ("tucumâ") yields products similar to those of *Elaeis guineensis*, namely a pericarp oil ("oleo de palma") and a kernel oil ("oleo de palmito"), but its fruits are 10 times bigger than those of the oil palm. — *Astrocaryum Jawary* ("jawary") also yields a pericarp oil and a kernel oil. On the other hand, *A. Mumbaca* ("mumbaca"), *A. peruvianum* ("huycungú"), and *A. rostratum* only furnish an oil extracted from the kernel.

Bactris major ("marajá assú"), *B. minor* ("marajá") and *B. goemooides* ("marajary") have an oily kernel.

Oenocarpus distichus ("baccaba"), *O. minor* ("bacobinha"), *O. malitcaulus* ("ciambo"), *O. Batana* ("patana") and *Oenocarpus* sp. n. ("bababão") have seeds which yield a very fine edible oil much superior to that of cotton seeds, but in small quantity only.

Many species of *Altalea* produce kernels which give very high percentages of an edible oil, very sweet, resembling that of the coconut.

Cocos Inajai (=*C. equatorialis*) ("jarená") and *C. Syagrus* ("potorema") supply an oil almost equal to that of *C. nucifera*.

Pentaclethra filamentosa ("pracaehy") furnishes an edible oil in abundance.

Pachira aquatica ("mamorana") yields a highly aromatic and edible fat.

Erisma calcaratum ("caramurú" or "jaboty") supplies a very thick fatty substance.

Lippia (Platonia) insignis ("bacury") yields a somewhat resinous fatty substance.

Bertholletia nobilis (=*B. excelsa*) ("castanha do Pará") and *Lecythis usitata* ("sapucaia") produce an oil very similar to that of sweet almonds.

Dipteryx odorata ("cumará") supplies a very delicate aromatic oil in abundance.

Bombax Munguba ("Monguba") and *Eriodendron anfractuosum* (= *Ciiba pentandra*) ("sumaima") yield seeds which furnish an oil similar to that of cotton.

Guilheminea speciosa ("pupunha") has fruits of fine flavour the seeds of which furnish an abundance of oil similar to that of the coconut.

Sapindus Saponaria ("saboeiro"), very common in the Lower Amazon; its fruits have a skin which contains about 30 % of saponin, from which a highly esteemed soap is made; its kernel yields an edible oil very like that of the olive.

Hevea brasiliensis ("syringa") produces a drying oil.

Sacoglottis Uchi ("uchy") furnishes an edible oil.

Poraqueiba serica ("umary"), from the pericarp a highly aromatic oil is extracted.

Theobroma microcarpa ("cacao-rana"), *T. speciosa* ("cacao-y"), and *T. grandiflora* ("cuprassú") provide aromatic substances. Their fats are also used as a substitute for cocoa.

Matisia paraensis ("capuassurana") produces oil.

Copaifera guyanensis ("copahyba") furnishes the well known medicinal oil on tapping the tree.

Sacoglottis amazonica ("uchy-rana"), *Sympomia globulifera* ("anany") and *Rheedia macrophylla* ("bacury-pary") furnish copal and oleo-resin.

The Author points out that he only enumerates the most important and most common plants in the State of Para, and he also gives a list of several other plants the botanical identification of which has not yet been carried out.

§5.—Description of the Varieties of Sugar Cane under Extensive Cultivation. — JES-
WER J., in *Mededelingen van het Proefstation voor de Java-Suikerindustrie, Archief voor de
Suikerindustrie in Nederlandsch Indië*, XXIVth Year, Parts 12 and 13. Soerabaja, March
and April 1910.

SUGAR CROPS

The importance is emphasised of a good description of the different varieties of sugar cane under extensive cultivation, with a view to ascertaining their individual characteristics, preventing a mixture of the cuttings ("bibit") used on the plantations and obtaining a guarantee of purity and origin. Besides this, the inspection of the plants and examination of the cuttings imported or purchased from nurserymen is only possible if a precise description of the known varieties is available.

The different proposals of other writers who have dealt with the question of systematising the knowledge of the sugar cane are reviewed and rejected, owing both to the insufficiency and the inconstancy of the characters described.

In the form of the internodes, their colour and the mode of insertion of the leaves, some fairly fixed and absolute distinctive characters were found in the sugar cane from 4 to 9 months old. It is chiefly however in the form of the buds and also the distribution of the hairs over the outer scales of the buds and on the different parts of the leaves, that a sure means has been discovered for identifying the different varieties and combining them in certain groups representing the same characters and probably of the same origin.

A description is given of the 2 most important varieties of sugar cane grown from seeds in Java and designated by the numbers 247 B and 100 P. O. J.

The origin of No. 247 B. is somewhat doubtful and it is probably to be attributed to a cross of the Fiji cane with the Cheribon cane as the female parent.

The variety 100 P. O. J. was obtained by accidental hybridisation of the original black Borneo cane, probably with the Loethers cane. The writer believes that the latter may be identified as the male parent on comparing different characters of the cane 100 P. O. J. with those of the Loethers variety.

A minute description is given of the various morphological characters of these 2 varieties, on the basis chiefly of the insertion and dispersion of the hairs over the buds, and on the shape of the internodes.

866 - **The Problem of Nitrogenous Manuring of the Sugar Cane in Java (Sulphate of Ammonia or Oil Cakes?); Results of 10 Years of Experiments.** — GEERTS J. M., in *Mededelingen van het Proefstation voor de Java-Suikerrindustrie, Archief voor de Suikerrindustrie in Nederlandsch-Indië*, XXIVth year, Part 14. Soerabaja, April 1916.

The importation of sulphate of ammonia generally used for manuring the sugar cane having become very uncertain and difficult, the question of finding a substitute for it is one of primary importance. It appeared possible to find the solution of the problem by making a digest, from one and the same point of view, of all the results obtained for 10 years of experimental manuring of the sugar cane in the field and calculating them uniformly. This has now been done, and the results given by earthnut cake have been compared with those yielded by sulphate of ammonia.

The conclusion reached is that the former cannot be deemed equal to the latter. A mixture of the two manures gives better results than the use of oil cakes alone.

In rather sandy soils, the oil cakes produce better results than in clayey soils. The nitrogen in sulphate of ammonia not being so expensive as that in oil cakes it is more economical to use the former.

The production of the sugar cane is less when oil cakes are used than with sulphate of ammonia, but the richness in sugar is not affected.

867 - **A Pre-fermentation in Special Stacks of Tobacco.** — DE VRIES O., in *Mededelingen van het Proefstation voor Vorstenlandsche Tabak*, No. XXIII, pp. 69-88. Semarang, 1914.

In 1914 the tobacco-growing season in a part of Java was marked by great dryness.

The tobacco harvested during these times of drought frequently shows traces of the pressure undergone after fermentation, these traces remaining visible in the form of streaks and spots on the leaves when put up into bundles for the market.

Experiments were made in 1914 to remedy this drawback, which considerably reduces the value of the tobacco. Fermentation stacks were designed the centre of which remained empty, and in which the air could circulate more freely than in the ordinary form of stack. Taking care that the

temperature in these stacks should not exceed 35° C., the results obtained are very satisfactory.

Subjecting the tobacco thus treated to the usual fermentation hardly any trace of pressure could be observed. It is thought that this result may be interpreted as pointing to a slow oxidation, which during the process of the death of the leaves in the preliminary stacks, destroys certain essential oils which, owing to rapid heat, such as occurs in the ordinary stacks (here the temperature frequently reaches 54° C.), are decomposed. The products of decomposition, impregnating the dry cells, form pressure spots in the leaves, which marks persist during all the subsequent operations of handling the tobacco.

S - Investigations into the Combustibility of Tobacco. — I. DE VRIES O., Method of Research. — II. DE VRIES O., Influence of Manure on the Combustibility of Tobacco. — III. SIDENIUS R., Enquiries into the Combustibility of Tobacco, in *Mededeelingen van het Procuratissen voor Vorstenlandsche Tabak*, No. 22, Semarang, 1916.

FRUIT
GROWING

Combustibility is first of all defined as : "the time occupied in the combustion of a leaf of tobacco stretched horizontally and ignited near its central part." At the same time the colour of the ash in small cigars made with tobacco of the same origin and allowed to burn themselves out was observed. A scale of colours facilitated an estimate of the differences.

According to the results from the experimental fields where the tobacco is treated with different manures, no influence of the manure on combustibility was observed.

It seems as though the properties of the soil and the climate have a predominating influence. A tobacco originally defective in combustibility cannot be improved by a special manure. Only a potassic manure in large quantities, which is then very expensive, may sometimes produce good results. Thus, a dose of 0.75 oz. (20 grams) of nitrate of potash per plant produced some effect.

Flooding of the tobacco fields occasionally during periods of drought may considerably impair combustibility.

A lesser combustibility was found in the leaves near the top as compared with those at the end, especially if the rains do not fall until near the end of the cultivation.

The attempt was made to inject potash salts into the plants, but without positive results.

S - Attempted Classification of Pears. — CHASSET LOUIS, Compte-rendu par GABRIEL LUTZER, in *Journal de la Société Nationale d'Horticulture de France*, 4th Series, Vol. XVII, pp. 74-78. Paris, May 1916.

The idea of classifying and determining these fruits was first dealt with by ROBERT HOGG in 1851, then renewed by him in 1884 in reference to apples only. In France, WILLERMOZ made the greatest effort in this direction. In 1912, at the French Congress of Apple Growers at Limoges, two men JULES JOBIN and LOUIS CHASSET, each submitted a preliminary scheme differing little from each other, although carried out at 600 kilometres distance without any consultation.

M. LOUIS CHASSET carried his scheme into effect. According to his method, the pears are first of all studied as regards the dimensions in height and breadth.

First class : Fruit of the same breadth as height.

Second class : Fruits broader than they are high.

Third class : Fruits higher than they are broad : 1/10 to 2/10, 3/10 to 4/10.

Fourth class : Fruits higher than they are broad : 4/10 and more.

The first and second categories comprise the following forms : *spheriform*, *short turbiniform*, *form*, *short doliform*, *short cydoniform*, *maliform* and *flattened turbiniform*.

The third class comprises : *doliforms*, *ovoids*, *turbiforms*, *truncated turbiforms*, *piriforms*, *truncated piriforms* and *cydoniforms*.

The fourth class comprises the last forms adopted : *long piriforms*, *calebassiforms* and *oblongs*.

In each of these forms, 21 periods of ripening were created : June, June-July, July-August, etc.

Each of these times of ripening presents a picture in which the colours of the skin of the fruit are noted ; these colours are : dark green, light green, reddish, russet or bronzed ; the yellowish colour put down at first was afterwards struck out as being useless.

After the colour of the skin the next thing dealt with is the stalk, which is divided from the point of view of dimensions into long, medium or short, and of consistency, into fleshy or not fleshy at the base ; and of position, into straight, oblique or arched.

Carrying the selected characters still further, the flesh is next examined as to its colour : white, yellowish, greenish, salmon ; then as to its taste : sweet, acid, wine, musk, tart.

The complete work comprises 5 volumes, the contents of which have been condensed into a single volume which forms a popular edition. Mr. CHASSET, in order to facilitate this demonstration to the public, has prepared 8 tables, summing up the whole of his work. Thanks to these tables, various fruits were classified with great facility and rapidity by a meeting to which Mr. CHASSET submitted his work.

870 - *Pyrus calleryana*, an Interesting Species of Pear Tree. — REIMER, F. C. in *The Monthly Bulletin of State Commission of Horticulture*, Vol. V, No. 5, pp. 166-174, 2 fig. Sacramento, California, May 1910.

In 1908, Mr. GEORGE COMPERE, during a voyage in China, was struck by the resistance of a species of pear tree to "pear blight" or necrosis of the bark of the branches (*Bacillus amylovorus* [Burr.] De Toni); he therefore introduced this species into California, believing it to be the "Chinese sand pear", *Pyrus sinensis* Lindl. The writer has studied this pear tree, and found that it was not *P. sinensis* but the species *Pyrus Calleryana* Decaisne. *P. Calleryana* occurs very widely in China, where it is found both in the south, the east, the centre and the west. It grows at all altitudes up to 5000 feet. It is distinguished from *P. sinensis* by its leaves, which are relatively shorter, wide, with rounded or widened base, and with rounded or crenate teeth along the edges. In addition *P. Calleryana* generally has

or 4 carpels, rarely 2 or 5, while *P. sinensis* generally shows 5, rarely or 4.

P. Calleryana has been found highly resistant to pear blight. Inoculation trials carried out by the writer showed that the species, if not absolutely immune, is at any rate very little affected; if the infection develops in one year old wood, it never gets as far as the two or three year old wood.

In no case does it develop in branches with a diameter exceeding 1/2 an inch. A two year old *P. Calleryana* was inoculated at the end of the soft and vigorous branches, as well as in the trunk. The disease did not appear in the trunk, while it did develop in the *P. communis* used control and inoculated in the same way.

The writer's opinion is that the species in question has not received the attention it deserves from the point of view of fruit production. At the Southern Oregon Experiment Station, which has perhaps the largest collection of pear tree species in the world, *P. Calleryana* was quite successfully grafted on *P. communis* as well as *P. sinensis*. As soon as the writer has sufficiently large seedlings of *P. Calleryana* he will shield-graft them on different varieties of *P. communis*.

- The Orange Tree in Algeria. — TRABUT L. in *Bulletin Agricole de l'Algérie-Tunisie-Maroc*, and Series, 21st Year, No. 11, pp. 273-278. Algiers, Nov. 1915.

For some years past the Algerian colonists have been actively growing orange, and when seeking for information and guidance in reference to fitting an orange plantation, they sometimes meet with discordant views. The writer proposes to correct some current errors.

It is asserted that the orange tree will not grow as far down as the Sahara, i.e. according to the writer's testimony there are no better oranges than those gathered in some oases. The "Biskra Blood Orange", which has been grown in that oasis for some years now, is delicious, and fetches very high prices. In the Djerid there are also excellent oranges, and the writer bought back a thoroughly first-class variety from Deggaeah; The free oranges there are very fine and covered with fruit; they thrive well beneath date trees. In the oases, it would be necessary to make provision, as elsewhere, for a grafting stock possessing resistance to gummosis of the tree; which is not done by the natives, who simply sow sweet oranges or graft them on to a lemon tree; which makes certain failures inevitable, above all with basin irrigation.

As regards seed plots and plants, an example is reported from Arba, where a settler who undertook the plantation of 247 acres of orange trees sowed his Seville oranges on a hotbed beneath a glass frame, early in February. About the 15th April the young plants are put into tapering pots about 10 ins. in diameter on top, and about 11 ins. in height. These pots are buried in the beds early in June; during the summer they are watered plentifully, and every month they are given a few grains of blood and superphosphates. At the end of November the plants may easily reach a height of 3 to 29 ins., and three months later, i. e. 13 months after sowing, they are planted out and grafted seven months afterwards, about the month of October following planting. These trees grow rapidly, and six years after

sowing they are in bearing, and capable of yielding from 400 to 600 fruits. In no case should the orange tree stem be subjected to persistent moisture; the planting must be done so as to keep the top of the root outside the soil, and to prevent gummosis of the foot of the tree the practice of basin irrigation has been everywhere abandoned.

The General Government of Algeria has for the last twenty years made a collection of the best orange trees from different centres of cultivation : Spain, Portugal, Canaries, Italy, China, Japan, Australia, Brazil, Florida, California, etc. In this collection, a quantity of varieties far superior to those already acclimatised are to be found ; these varieties ripen almost successively from November to June, and answer both the requirements of cultivation and trade and the taste of consumers. It would be of interest to look for a site in Algeria for grape-fruit or "pomelo", *Citrus* which should not be confused with the shaddock to which it very closely approaches. The botanical Station of the General Government successfully grows the best varieties of "pomelo". *Citrus japonica* or "cumquat" is increasingly used in preserves. The "Washington Naval" orange, which has given excellent results in almost all orange-growing countries, should be recommended for Algeria likewise, and some confusion exists when an introduction dating back more than fifty years is spoken of.

872 - *Diospyros virginiana* ("Persimmon") in the United States. — FLETCHER
W. P., in U. S. Department of Agriculture, *Farmer's Bulletin*, No. 685, 28 pp., 17 figs.
Washington, D. C., October 12, 1915.

This Bulletin gives the following general information with regard to *Diospyros* : Botanical classification, Natural distribution, General description, Possibility of improvement, Methods of spread and cultivation, Diseases and pests, Uses of the tree and its products, Recipes for the preparation of cakes, jams, ices, etc. from its fruits, and List of particular varieties selected and cultivated.

Diospyros virginiana was described and much esteemed from the early times of the discovery of North America. It is a native of the south-eastern part of the United States, where it abounds in fields and forests. Some cultivated specimens, however, also did well in the States of Rhode Island and New York, which proves that the northern limits of this species may lie very high when aided by cultivation. The region where *Diospyros* produces most and to which it is best adapted, extends from Maryland, Virginia and the two Carolinas westward through Missouri and Arkansas. It thrives in every description of soil. The species is generally dioecious. With regard to the habit of the tree, there are 2 types : one with ascending and the other with descending branches ; some fruits are oblong in shape, others are pear-shaped. The period of ripening varies very much : ripe fruits may be obtained from August to February.

The fruit of *Diospyros virginiana* is far from being as much appreciated as it deserves in its native country, in spite of the fact that it is much more nutrient than the ordinary fruits of temperate countries. The only fruit which can be compared with it is the date. In addition to consuming the

ruit raw, household drinks are made from it, and it is eaten by pigs put out to grass and by dogs.

*Chemical composition of the fruit of *Diospyros virginiana* (average of 6 analyses made in 1896 at the Indiana Station).*

Dry substance	35.17 %
Ash	0.78
Protein	0.88
Sugar (Nitrogen-free extract)	31.74
Cellulose	1.43

A description of the following varieties is given: Burrier, Boone, Delias, Early Bearing, Early Golden, Golden Gem, Hicks, Josephine, Kansas, Miller, Ruby, Shoto and Smeech.

It is advised that *Diospyros* should be grown both by sowing and grafting.

Diseases and pests — This species is exceptionally free from diseases and pests. The most dangerous of the latter is perhaps the "hickory twig girdler" (*Oncideres cingulata* Say), the larva of which bores tunnels in the wood of the young branches. The injury is caused by the mode of oviposition. The adult devours a small amount of bark, generally immediately above or below a bud, and by means of the ovipositor inserts the egg beneath the bark. Generally, several eggs are thus laid along-side each other, so as to form a ring-shaped incision which causes death and fall of the ends of the young branches. For control it is necessary, in June or the beginning of July, to collect the small twigs which have fallen to the ground and burn them, so as to destroy the insects inside.

§73.—The Date Palms of Egypt and the Sudan. — MASON S. C., in *United States Department of Agriculture, Bulletin No. 271*, 40 pp., 9 fig., XVI tables. Washington, D. C., September 28, 1915.

The first date seeds imported into the United States came from Egypt. As great confusion exists in the classification of the varieties of this great date-producing region, so much so that the identification of some of the best varieties tried in the United States (Palm woods of Tempe and Mecca) is rendered doubtful, the Research Office in connection with the selection and physiology of cultivated plants, and the Foreign seeds and plant Importation Office of the United States Department of Agriculture, sent the writer, in August 1913, to Egypt and the Soudan to study the varieties of date trees. In the above Bulletin the writer described 22 varieties in Egypt and the Soudan. They comprise the majority of those having any commercial importance, and also several others of less importance but which had hitherto not been described.

The cultivation of the date in Egypt and the Soudan dates back to very ancient times. At present these countries possess about 9,000,000 date palms, the production of which is valued at about 4s. per tree. No more than one fourth of these trees belong to any of the 12 varieties of commercial importance (Aglanay, Amhat, Amri, Barakawi or Ibrimi, Ben-

Meteorological data relating to the three great climatic zones of Egypt and the Sudan and the varieties of date palms characteristic of each type of climate.

Zone and locality	Relative average humidity	Mean temperature in degrees C.			Varieties of date palms cultivated in the different localities
		Annual	From February to October	Units of heat above 18°C. during the period 1st May to 31st October	
<i>Subtropical seaboard.</i>					
Alexandria	68	20°.17	21°.31	1 138	Aglany, Amri, Bint Aischa,
Port Said	74	20°.53	21°.59	1 217	Hayany, Kobi, Samany,
Gizeh	69	19°.60	21°.59	1 211	Zagloul.
Abbasia	62	21°.09	23°.15	1 508	
<i>Subtropical desert.</i>					
Bedrashen	—	—	—	—	Amhat, Hamrawi, Hayany,
Helouan	54	20°.50	22°.52	1 412	Siwali.
Fayoum	—	—	—	—	
Siont (Assiout).	53	21°.27	23°.38	1 748	
Dakleh	36	23°.29	25°.78	2 042	Saidy, Sultany, Tamr, Hamrawi, Falig, Barakawi, «Bartamoda», Godella, «Ibrimi».
Assouan	39	25°.17	27°.74	2 387	
<i>Tropical desert.</i>					
Ibrim	—	—	—	—	
Wadi Halfa	34	25°.03	27°.52	2 311	«Ibrimi», Barakawa, Bent-
Merowe	24	26°.58	29°.78	2 615	moda, Gondeila, Kosha,
Atbara	38	27°.63	29°.42	2 475	Kulma.
Khartoum	33	28°.31	29°.83	2 442	

tamoda, Bint Aischa, Hayany, Saidy, Samany or Rashedi, Siwak, Tamr and Zagloul). The others are seed trees, producing cheap inferior fruit.

The date cultivation in the Nile valley extends almost uninterruptedly from the Mediterranean coast to Khartoum, for about 1123 miles. This is the tract where, from north to south, it occupies the largest continual extent existing in the world. Between Alexandria and Khartoum, which are the outermost points of this cultivation, there is a difference of 10.0°C in the mean annual temperature, and the corresponding mean moisture ranges from 74% at Port Said to 24% only in the province of Dongola.

Jan. For convenience in his work of study the writer divides this country into three zones : 1) subtropical seaboard, which comprises the delta of the Nile as far as Cairo ; 2) subtropical desert, containing the valley of the Nile from Cairo to Assouan and the western oases ; 3) tropical desert, comprising the parts of the Nile valley where the date is cultivated between Aswan and Khartoum. In the accompanying Table the particulars recorded in 12 meteorological stations of Egypt and the Soudan are condensed, and the varieties of date palms characteristic of each region are noted. It is seen from this table that 1) the fresh and moist seaboard produces few dates for drying and exporting, the production being exclusively dates which are eaten fresh (Bint Aischa, Hayany, Kobi, Saqiy and Zagloul) ; 2) superior quality drying dates are produced in the moderately hot and dry parts of the subtropical desert zone ; 3) the hot and least moist part of the subtropical desert zone, and the tropical desert zone, produce almost exclusively the hard dates, self-drying, very rarely kept and transported, which make up so considerable a part of the diet of the Arab population.

1 - Raisin Production in the United States. — HUSSMANN GEORGE C., in *United States Department of Agriculture Bulletin No. 349*, 15 pages, 3 fig. + 9 tables. Washington, D. C., March 17, 1916.

VINE GROWING

With the exception of very small quantities produced in Arizona, Utah and New Mexico, all the raisins produced in the United States come from California (1).

The first introduction into California of the species of vines intended for the production of raisins date back to 1851, in which year the Muscat Alexandria was sown ; in 1861, plants of the stocks of Gordo Blanco and Alvarado were imported from Spain, and stocks of red and white currants from the Crimea.

The first raisins were produced in California in the valley of San Bernardino. In 1873, the production of raisins having amounted to 120 000 lbs., the industry began to assume some commercial importance for California ; the appended summary of the trade shows how rapid its progress has been. In 1892 the production of California equalled that of Spain ; at present it is about three times as great. The annual consumption of raisins per inhabitant is about $1 \frac{1}{2}$ lbs. in the United States against 5 lbs. in Great Britain.

At present, 110 000 acres are devoted to the growing of grapes to be dried as raisins ; out of 58 counties of California, 11 produce a quantity of any commercial importance, the county of Fresno alone supplies about 60 % of the State production. The greater part of the production is yielded from vineyards of 10 to 50 acres each.

The Alexandria Muscatel, which is the most important raisin stock, is, in addition to the first crop for drying, supplied a good second crop which is made into wines or alcohol, and sometimes a third. The grafting hosts used to it are, in decreasing order of merit : Riparia \times Rupestris 3 309,

(1) See *B. May 1916*, No. 558.

(Ed.)

Production and trade in Raisins in California.

Year	Production in California	Exports during the fiscal year ending June 30		Imports during the financial year ending June 30	
		Quantities lbs.	Value dollars	Quantities lbs.	Value dollars
1885	9 400 000	—	—	38 319 787	2 661 66
1905	87 000 000	7 054 824	372 087	4 041 040	3 112 05
1915	250 000 000	24 845 414	1 728 547	2 802 901	2 719 2

Riparia × Rupestris 101, Dog Ridge, Riparia × Rupestris 101-14, Be landieri × Riparia 420 A. Second in order of importance is the Sultana. The vine is well adapted to the following grafting stocks, in decreasing order of merit: Riparia × Rupestris 3 309, Dog Ridge, Aramon × Rupestri Ganzin No. 1, Riparia × Rupestris 101, Lenoir, Solonis × Riparia 161b.

The red Currant or Panariti has been found to be well adapted to Rupestris St-Georges, Mourvèdre × Rupestris 1202, Aramon × Rupestri Ganzin No. 1, Riparia × Rupestris 3309, Salt Creek and Dog Ridge (all ranged in order of merit).

Drying is effected in the sun entirely; sometimes before drying the bunches are washed or steeped in boiling lye (the Author gives no formulae of the latter as used in large establishments).

875 - Hot Water Treatment of Tree Seeds used in Reafforestation and of poor Germinating Capacity. - HOXING J. A., in *Mededeelingen van het Delt Proefstation*, Xth Year, Part 1, pp. 16-23. Medan, March 1916.

The seeds of *Albizia moluccana*, *Pithecellobium Saman*, *Mimosa invisa* and *Crotalaria striata* were steeped in warm water at various temperatures in order to ascertain to what extent this treatment would promote germination.

With the seeds of *Albizia*, the best result was obtained by using water at 60° C. The seeds are dropped into this water, which is then allowed to cool for 3 hours.

For *Pithecellobium* seeds somewhat hotter water (70 to 75°) is preferable. The seeds of *Mimosa invisa* germinated most easily after a treatment with water at 60-70° C.

With the seeds of *Crotalaria* no advantageous result is obtained by steeping in water.

The above experiments were carried out in Java.

876 - The Eucalyptus in Algeria. - TRABUT, in *Comptes Rendus de l'Académie d'Algérie*, Second Volume, Year 1916, No. 25, pp. 699-702. Paris, 1916.

As far back as 1862 some plantings of *Eucalyptus* were made in Algeria. There was first some enthusiasm for *E. globulus*, but afterwards preference was given to the Red gum group, and under this name there were propagated *E. rostrata*, *E. rufa* and *E. tereticornis*, often erroneously called *E. resinifera*.

The three species have crossed; they have even hybridised with remoter species, such as *E. botryoides*.

The writer discusses the uses of the *Eucalyptus* and combats the prejudices existing against this tree. Formerly, for instance, its wood was regarded as a bad fuel. The high price of coal however has resulted in trials of wood stoking of furnaces, and it has been found that 563 lbs. of dry branches of *Eucalyptus* can replace 220 lbs. of coal briquettes (1). *Eucalyptus* can also be used for telegraph poles or railway sleepers. Old building frameworks made of *Eucalyptus*, are already in existence. It is also beginning to be esteemed in cart and carriage building. Finally, some very fine "Red gum" furniture places the value of this wood for cabinet making beyond doubt.

The writer points out the following species, indicating the use for which each is best adapted; *E. globulosus*, very rapid growth in deep soil, utilised in the harbour works of Algiers; *E. Red gum*, the two hybrid forms *E. algeriensis* and *E. Trabuli* are to be preferred to the original species *E. rostrata*, *E. rufida* and *E. tereticornis*; *E. cladocalyx* or *corynocalyx*, highly resistant to drought, upright trunk, very regular, hard wood, is suitable for telegraph poles and railway sleepers; *E. diversicolor* or *colossea*, the Australian "Karri", very widespread, same uses as the last named; *E. gomphocarpa*, the Touart, and its hybrid *E. gomphocornuta* Trab., a very fine tree, good wood, rare; *E. occidentalis*, var. *oranensis*, a fine tree in the salt soils of Oran, abounding in the domain of Habra; *E. robusta*, with the last named in the salt soil of the domain of Habra; *E. obliqua* or *gigantea*, fine specimens of the forestry Station of Bainem, light wood, easily worked, attains great growth in deep soils; *E. maculata* very upright trunk, high, resistant wood, difficult to raise in its young stage; *E. viminalis*, very fine specimen at Djebel-Ouach, Constantine (altitude 3300 feet); the seeds should be gathered here in order to grow the tree at Stations of similar elevation in Djebel-Ouach; *E. botryoides*, a species presenting numerous varieties, probably hybrids, of fine growth; a selection of these should be made. In *E. botryoides* the leaves have the normal horizontal position; this species is much more shady than its fellows; it is a fine avenue tree, with a very beautiful wood which looks like mahogany.

LIVE STOCK AND BREEDING.

§ 7.—Experiments in Control of Livestock Epidemics by means of Methylene Blue.—

RAEBIGER and RUTTMANN, in *Berliner Tierärztliche Wochenschrift*, 32nd Year, No. 22, pp. 253-258. Berlin, 1st June, 1910.

Since December 1913, the writers have been conducting experiments with a view to combating various epidemic diseases of livestock by means of methylene blue (*Methylenum caeruleum medicinale* Höchst), introduced into the stomach of the animals. It is well known that methylene blue tends to

(1) See *B. July 1916*, No. 789.

(Ed.)

make its way into the bacteria, combining with their cell-contents and afterwards killing the organisms. Very important experiments in this connection have been made up to the present at the agricultural experiment Station of Vermont (United States) for prevention of epizootic abortion in cows. Among 92 cows infected with the abortion bacillus, and to which the methylene blue had been administered, no actual abortion occurred.

The experiments carried out in America were repeated by the writers, but they are not yet able to pronounce an opinion as to their accuracy, the trials not yet being completed. In the treatment of swine fever and infectious enteritis, results have already been obtained which constitute an inducement to continue experimentation with methylene blue on a more extensive scale.

It was first of all observed that 4 pigs evidently ill with fever were cured after a treatment with 0.75 to 1 gr. of methylene blue per day per head. In 4 days an improvement was already observed, and within 3 weeks all the animals were cured. A similar result was secured in other piggeries containing a large number of animals. For the control of infectious enteritis comparatively small doses of methylene blue were used, administered regularly for at least 10 to 14 days. To increase the effect of the internal disinfection, the sties were disinfected every day after removal of the droppings.

To sum up, it may be said that the experiments carried out with methylene blue for the treatment of swine fever and infectious enteritis have shown that cures may be obtained, above all when the disease is located in the digestive organs. In cases of true infectious enteritis with serious pathological changes of the lung, the effect of the remedy was less pronounced; it seemed if anything to hasten the death of dying animals. When the critical stage of the disease is passed the remedy must not be administered, because its bitter taste tends to reduce the appetite of the animals.

The attempt was also made to ascertain whether methylene blue administered to pigs has a detrimental effect on the fat and the meat. For this purpose, 0.1 gr. of methylene blue per day was administered to a pig of medium weight from the 11th December, 1915 to the 3rd January, 1916 (except from the 21st to the 23rd December), which was then slaughtered.

The post-mortem showed that neither the meat nor the fat were affected and that the symptoms occasioned by the methylene blue were localised in the stomach, where the glandless part particularly was coloured blue. The mucous membrane of the caecum was also slightly blue in colour, but the small intestine in a few places only.

The experiments will be continued by the writers with the support of the Prussian Ministry of Agriculture, at the bacteriological Institute of the Chamber of Agriculture of the Province of Saxony, at Halle a. S.

878 - **Influence of Colour in Horses on the Cure of Mange.** — MÄSER, in *Berliner Tierärztliche Wochenschrift*, 32nd Year, No. 25, p. 294. Berlin, June 22, 1916.

When treating numerous cases of mange, it was observed that the colour of the horse has some influence on the cure of the disease. Cure was completed most rapidly in black horses, where often no formation of crusts

ven was observed. To cure them it was mostly sufficient to rub them with some ordinary remedy. In bay horses, cure required a greater length of time. In chestnut horses the treatment had almost always to be repeated. In white horses, above all those with a uniform coat, treatment repeated a second time did not always bring about a cure, which observation was confirmed by other veterinary surgeons. These results were not affected, no matter what drug was resorted to for cure.

The writer is at a loss to explain exactly the cause of this phenomenon, as he thinks acarids enter more easily and more deeply into the skin containing no pigment and are thus more difficult to get at by the curative agent than in animals with pigment.

39 - A Contribution to the Study of the Treatment with Sugar of Surgical Injuries of the Foot in Horses. — BINNI PAOLO, in *Il Moderno Zootiato*, Vth Series, Vth Year, No. 4, pp. 109-115. Bologna, April 30, 1915.

A description of several cases of foot injury which the writer treated with sugar. His observations agree with those of PROF. BUSSANO (1), as regards the absorbent, antiseptic, cicatrising and cleansing powers of sugar. They also prove that sugar possesses the property of promoting the formation both of the soft tissue of the foot and of the horny tissue. As regards this latter property, sugar exceeds all substances in common use heretofore in the treatment of surgical injuries of the foot (SOCIN's powder and aste, naphthaline, carbolic oil, etc.).

40 - The Importance of Silage in the Economics of Livestock Feeding, on Farms in East Anglia. — JAQUES G., in *The Journal of the Board of Agriculture*, Vol. XXII, No. 12, pp. 1249-1252. London, March 1, 1916.

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AND FEEDING

The economics of milk and meat production and of livestock feeding generally, during the winter, constitutes at the present time a problem of the utmost importance, especially in East Anglia. The climate there is mainly of a rather dry character, so that the growing of forage roots is uncertain and the farmer is compelled to look for a solution of the problem along other lines, among which the ensilage of green leguminous forage has latterly assumed special importance.

By this means the Author was able, in Norfolk, to produce milk at a cost of about $3 \frac{1}{3} d$ per gal. for food, or, roughly half of the cost of feeding with roots forming the basis of the ration. A similar reduction was found in the cost of production of meat and breeding stock.

The saving of nitrogenous manure realised on this method, by using light phosphates alone for leguminosae grown every other year, is one of the factors having the greatest influence on the economics of production; besides which, owing to the conditions prevailing in East Anglia, saving labour is no less important owing to its shortage and high cost. The same applies to forage economy in general, above all as regards concentrates as compared with feeding with a basis of roots. The particulars here produced as to the cost of silage, its composition, and the method of feeding

it to cattle, were taken by the writer from the accounts kept on his farm in 1915, after 3 years' use of silage. The farm comprises 105 acres of arable second-rate heavy land, and 45 acres of pasture.

Cost of growing one acre.

	£ s. d.
Rent	1. 0. 0
Basic Slag	12. 0
Ploughing	10. 0
Harrowing	1. 0
Seed (1 $\frac{1}{2}$ bush. of tares, $\frac{1}{2}$ bush. of beans, 1 bush. of oats, 1 peck of rye)	1. 0. 0
Seeding	2. 0
Rates	4. 0
Steam Cultivating twice after crop is removed	1. 0. 0
Rolling	9
	<hr/>
	£ 4. 10. 3

Cost of cutting and getting ready one acre for carting .

11. 0

Cost of filling silo 16ft. by 39ft., capacity 20 tons:

	£ s. d.
8 men at 4s. per day for 6 days	9. 12. 0
3 boys at 1s. 6d.	1. 7. 0
5 horses at 3s.	4. 10. 0
Engine and driver at £ 1 per day for 6 days	6. 0. 0
Silage Cutter at 15s. per day for 6 days	4. 10. 0
Coal	2. 0. 0
Beer	2. 18. 0
	<hr/>
	£ 30. 17. 0

13 acres filled the silo to the top, and the *cost of filling per acre*

acre = £ 30 17s. od. ÷ 13 = £ 2. 7. 6

Total cost of silage per acre.

	£ s. d.
To grow	1. 10. 3
To cut	11. 0
To fill	2. 7. 6
Interest and depreciation of silo at 10 per cent.	1. 3. 0
	<hr/>
	£ 8. 11. 0

Ration given to dairy cows from 1st October to 31st December 1915.

60 lb. Silage 3. 66 d.

24 lb. Turnips 1. 28 d.

1-6 lb. Concentrates (maize gluten

at £ 10 per ton) 1. 71 d.

6. 65 d.

This ration given to 17 Red Poll cows, produced during the first three months 32,254 lb. of milk or an average of 2 gal. per day, at a cost of 3.32

food per gal. This low cost was attained in an advanced period of tation during a period of comparatively low daily production, and it probably due to the high feeding value of the food forming the base of ration and the small amount of concentrates.

The analysis of the silage gave the following results :

Moisture	61.31
Albuminoids	4.75
Indigestible Fibre	11.25
Ash (Mineral matter)	3.28
Volatile Acid (acetic)	0.45
Non-volatile Acid (lactic)	0.78
Digestible Fibre, Chlorophyll, etc.	18.18
	100.00

Yearling store cattle were successfully wintered on 40 lb. per head per of silage with only water in addition, and beef cattle did well when fed similarly to the milking cows. On the basis of these results the writer believes that the silo, besides furnishing a large bulk of valuable food at a low t, offers the following advantages :

- 1) The certainty of an abundant supply of forage.
 - 2) Complete suppression of weeds.
 - 3) The forage is put into the silo in June and July, when the land generally dry and the days are long.
 - 4) There is no risk of loss from frost as with roots.
 - 5) The soil is cleared early and then prepared for growing turnips be folded off; heavier soils may be sown with mustard for green manure to be fed off by sheep ("bastard fallow").
 - 6) It allows of a great saving of labour as compared with roots.
 - 7) More stock can be kept on the farm than is possible with a crop roots; consequently more dung is available.
- It enables a high fertility to be maintained in the soil owing to phosphate manure with slag, the accumulation of nitrogen through pulse-growing, and a greater production of dung.

The milk obtained for the London market was always considered as excellent quality and good flavour ; its fat content was, in January, from 9 to 3.05 % ; that of solids-not-fat from 8.81 to 8.86 %.

b - Experiments on the Digestibility of Various Little-used Cattle Foods. — MORGENSTERN, BECKER, OHLMER, MICHALOWSKI in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. 58, No. 3 and 4, pp. 243-290, Berlin, April 20, 1916.

1. — *Foods from the fruits of Phytolacca.* — These foods are sold in Germany under the form of a reddish and also a greyish product. According to the statement of the firm which supplied them, the red food originates from the nut of the Sudan, while the grey food comes from the fruits "gavaquil", "Carthagena", "esmeralda", "tunaco" and "ohnedo". The food was finely ground, but afterwards a coarser product in chips or strings, as sold by the factories, was used. The reddish food, and also

the greyish, were tried both in flour and in chip form. The fruits used for the manufacture of these foods were dark brown in colour and of the size of a hen's egg. According to the botanical determination the fruit yielding the reddish food belong to the genus *Hyphaene* and those supplying the greyish food to the genus *Phytelephas*. The feeding trials (8 series) were made with 4 sheep and 2 pigs.

The pigs were first given 1200 gr. of hay of a known digestibility per day per head, then 500 gr. of hay were replaced by 500 gr. of the food which was being tested. The pigs, 3 months old, were first given 1 litre of full cream milk (goat's and sheep's) + 500 gr. of sliced potatoes, which latter were afterwards replaced by the chips, so that finally the ration consisted of 1 litre of milk + 1200 gr. of chips.

The excrement of both species of animals was gathered from the 10th day of experiment onwards. The feeds employed were of the chemical composition indicated in Table I.

TABLE I. — Percentage composition of the feeds tested.

Components	Reddish food		Greyish food	
	Flour	Chips	Flour	Chips
Dry matter	91.50 %	89.38 %	91.38 %	88.29 %
Ash	2.00	1.61	2.56	1.44
Organic matter	89.50	87.77	88.82	86.85
Crude protein	5.19 (= 0.83 N)	4.75 (= 0.76 N)	5.44 (= 0.87 N)	4.75 (= 0.76 N)
Pure protein	5.19 (= 0.83 N)	4.75 (= 0.76 N)	5.38 (= 0.86 N)	4.75 (= 0.76 N)
Fat	6.79	7.40	2.84	1.30
Crude cellulose	42.98	36.85	19.98	17.42
Nitrogen-free extract	34.51	38.77	31.06	33.38

It will be seen that the protein content does not differ very much between the various groups, but the fat content in the reddish food considerably exceeds that in the greyish food. This larger fat content is, according to the evidence of the microscope, due to the presence of fat globules contained in the seed coat of the Sudan nut. The content of crude cellulose and nitrogen-free extract is more variable, but these variations are if anything due to errors of calculation, and are in reality smaller than shown by the analysis.

For determining the digestibility of the nutrient elements, the method based on the nitrogen insoluble in acid pepsin (1) was chiefly used; taking into account however that the laboratory method most in use is that based

(1) For this method see : *Die landwirtschaftlichen Versuchsstationen*, Vol. 61, p. 12 ; Vol. 81, pp. 1-104.

on the total nitrogen or that of STUTZER, the writers also ascertained the coefficients of digestibility according these two methods.

Table II indicates the coefficients of digestibility.

TABLE II. — *Coefficients of digestibility of the foods tried.*

Substances	Sheep						Pigs					
	Flour			Chips			Chips			Chips		
	% red	% grey	% average	% red	% grey	% average	% red	% grey	% average	% red	% grey	% average
Organic matter	86.7	78.1	82.4	75.7	74.7	73.2	74.9	77.6	76.3			
Crude protein	59.2	60.6	59.9	26.3	60.5	—	46.7	57.1	51.9			
Pure protein	59.2	60.2	59.7	26.3	60.5	—	46.7	57.1	51.9			
Fat	90.6	74.7	82.7	93.4	32.3	—	88.5	—	88.5			
Crude cellulose	98.2	91.6	94.9	86.0	77.7	81.9	85.5	84.4	85.0			
Nitrogen-free extract	81.4	69.6	75.5	74.3	83.8	79.1	73.1	82.0	78.0			

From these figures the following conclusions are drawn:

1) The digestibility of the organic matter and its principal constituents, crude cellulose and nitrogen-free extract, is very good, both in the sheep and the pig. The fat was also well utilised, while the protein was less thoroughly digested.

2) The flour was digested better by the sheep than were the chips, but the difference is not sufficient to justify grinding. It is consequently more economical to use chips for sheep.

3) The pigs utilised the chips as fully as did the sheep.

4) There is only a slight difference in value between the reddish food and the greyish food.

5) Both the flour and the chips were readily eaten by the animals; they never caused any digestive troubles.

6) Crude cellulose particularly is highly digestible by the two species of animals. From this it may be concluded that it is not in a fibrous condition in the fruit, as FINGERLING has proved that fibre is not well utilised by pigs. This fact must be taken into account in forming an estimate of this food.

7) The food from the fruit of *Phytolacphas* provides a good source of digestible carbohydrates. Nevertheless they must be regarded as adulterants when mixed with other concentrates (earth-nut meal, linseed meal, &c.). If sold pure and at a low price, the farmer may buy them.

II. — *Hay meal.* — Ordinary hay was finely ground and then administered to 2 sheep and 2 pigs in order to determine its coefficient of digestibility. Of the 2 sheep, one first received 1000 gr. of chopped hay, then 700 gr. of hay were replaced by the same quantity of hay meal; the other re-

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ceived 1000 gr. of chopped hay all the time. In the 2nd experiment the rations were changed so that No. 2 also received hay meal.

To the pigs hay meal only was given, at the rate of 1000 gr. per head per day, with 1 litre of full cream milk.

The hay meal sifted through a Basic Slag sieve contained 60 % of fine matter. When examined with the microscope it was seen to consist chiefly of groups of cells with a little cell debris.

The digestibility was calculated from the total content of nitrogen insoluble in hydrochloric pepsin. It gave the following average starch value per 100 kg. of dried substance :

	Sheep		Pigs	
	Chopped hay	Hay meal	Hay meal	Hay meal
Calculated from the total nitrogen	25.5	26.4		17.6
Calculated from the nitrogen insoluble in hydrochloric pepsin	27.4	28.2		21.7

It is evident from these figures that the difference between hay meal and chopped hay in the case of the sheep is so small that it may be entirely disregarded. It may hence be concluded that grinding hay does not increase its digestibility. The pigs utilised hay meal less effectively than the sheep, which is quite intelligible.

The starch value alone however does not furnish a sufficient basis for a fair valuation of hay meal. It must be borne in mind that, owing to the reduction of the work of mastication, the digested nutritive elements are better utilised in the case of hay meal than with ordinary chopped hay. Nevertheless, according to the writers, this advantage may be obtained merely by chopping the hay very small. Consequently the grinding of hay is superfluous.

III. — *Cladonia rangiferina*. — These lichens were gathered in Allgäu (Bavaria), thoroughly dried in the sun and afterwards roughly ground. They were first given to sheep and pigs to see whether they would take them. It was found that at the outset they were reluctantly eaten, but when mixed with good forage the animals consumed them regularly. The quantity absorbed, however, was small. To enable pigs to accept the lichens well the latter must be freed from the disagreeable tannic substances by treatment with a solution of potash.

For the digestion experiments only a small quantity of lichens remained at the disposal of the writers, so that they had to content themselves with making a parallel experiment with one sheep. The lichens were administered without having been previously treated with the solution of potash. The animal was first given 800 gr. of hay of known digestibility after which 400 gr. of hay were replaced by 400 gr. of lichens.

The dry lichens had the chemical composition shown in Table III.

TABLE III. — *Percentage composition of the dry lichens.*

Dry matter 91.36 %	{ Organic matter	90.18 %
	Ash	1.18 %
Crude protein = 0.72 % N.	. . . . .	4.50
Pure protein = 0.72 % N.	. . . . .	4.06
Fats . . . . .	. . . . .	2.28
Crude cellulose . . . . .	. . . . .	41.01
Nitrogen-free extract . . . . .	. . . . .	42.39

The coefficients of digestibility were very low. On calculating them according to the total nitrogen, negative values were obtained. The starch value was likewise negative. All these analyses were confirmed by a microscopic examination of the excrement.

The writers conclude that lichens may be administered to sheep and cattle when there is a shortage of forage, but never to pigs or horses.

IV. — *Bone meal.* — This substance being at present often recommended in Germany as a food for ruminants and pigs, the writers carried it a digestion experiment with 2 sheep. The bone meal was administered to them in the proportion of 200 gr., with the addition of 800 gr. of hay. his ration was readily accepted.

The excrement was collected 10 and 11 days afterwards respectively.

The digestibility was very good for the protein, even reckoning the coefficients according to the total nitrogen. The fat is still more digestible.

Calculating the content of digestible elements according to the total nitrogen, the following figures are obtained :

Organic matter	40.6 %
Crude protein	26.6
Fat	7.3

The content of crude protein calculated according to the nitrogen soluble in hydrochloric pepsin was 31.1 %.

On calculating the starch value, by the aid of these figures, no result could be obtained which would allow of estimating the bone meal at its true value, as the result would relate to $\frac{1}{3}$ of fat and $\frac{2}{3}$ of protein. The protein is contained in it however chiefly in the form of collagen, a substance which is converted into glue during the process of digestion. The glue, in turn, is not a complete nitrogenous substance, as it lacks tryptophane, tyrosine and cystin. It is likewise unknown to what extent it is utilised by animals. Therefore as long as the value of glue and collagen as foods is unknown, it would be wrong to attribute an over-great food value to the organic matter of bone meal.

V. — *Blood meal as a food.* — The blood meal food corresponded in composition to that indicated by Kellner. It was given to 2 sheep in the quantity of 150 gr. along with 1200 gr. of hay.

The excrement was collected for 11 days.

The content of digestible elements in the blood meal according to the experiments, is shown by Table IV.

TABLE IV.—Content of digestible elements in the blood meal.

	Calculated according to total nitrogen	Calculated according to the nitrogen insoluble in hydrochloric pepsin
Crude protein	65.5 %	82.6 %
Pure protein	63.2	82.2
Organic matter	64.4	—
Starch value	59.4	77.3

The protein consisting exclusively of pure protein and being highly digestible, the blood meal forms an excellent food which should be bought if not too dear.

In conclusion, the writers say that the determination of the coefficients of digestibility according to the total nitrogen should be abandoned as it often leads to errors. The method based on nitrogen insoluble in hydrochloric pepsin should be adopted, or if this is found too complex, STUTZER's method should be employed.

882 - Nutritive Value and Digestibility of Wood; Feeding Experiments in Germany. — HABERLANDT G., in *Forstwissenschaftliches Centralblatt*, 38th Year, No. 6, pp. 273-279, Berlin, 1916.

With the support of Messrs. ZUNTZ and VON DER HEIDE of the Physiological Institute of the Superior School of Agriculture in Berlin, and that of the Prussian Ministry of Agriculture, a digestibility experiment in a respiration chamber was carried out with a sheep for the purpose of determining the nutritive value and digestibility of birch wood. The trees were felled at the end of March, and the trunks, which were 10 to 15 cm. thick, were converted into very fine chips by a paper mill. The microscopical examination of these chips showed that the wood was very finely divided, so that the membranes of almost all the cells were destroyed. The water used in preparing the chips had removed almost the whole of the cell contents, in consequence of which fact the experiment allowed of determining more particularly the digestibility and nutritive value of the cellular membranes.

The composition of the air-dried wood was as follows:

Water	4.56 %
Dry matter	95.44
Ash	0.49
Organic matter	94.98
Crude protein	0.67
Crude fat	0.45
Crude cellulose	32.30
Nitrogen free extract	61.56

The daily ration consisted of: 450 gr. of wood, 30 gr. of wheat gluten, 100 gr. of molasses, 75 gr. of starch, 5 gr. carbonate of lime, and 100 cc. of a saline solution. After a preparatory period of 17 days the period of experiment

proper began, lasting 6 days. It yielded the following coefficients of digestibility for the wood:

Organic matter	50.09 %
Crude cellulose	50.06
Nitrogen free extract	55.58
Calories	48.61

The digestibility was therefore excellent as regards the non-nitrogenous substances, the crude cellulose and the nitrogen-free extract. For the crude cellulose it is not below that of poor quality hay, and for the nitrogen-free extract it is 55.58 %.

To arrive at the true nutritive value of the chips, allowance must also be made for the greater work of mastication and the loss of elements resulting from fermentation. On deducting the loss of elements, etc., from the above values, there results per 100 gr. of wood fed to the animals, 84.9 calories capable of conversion into animal substance and work. Given that gr. of fat equals 9.5 calories, there are obtained in all from the 84.9 calories 9.4 gr. of fat. This figure is equal to a starch value of 35.8, which in turn corresponds to that of good meadow hay (36.2 according to KELLNER).

A microscopic examination of the excrement showed that it was not only the substances of the lignified cellular membranes easiest of decomposition (hemicellulose and pentosan) which were dissolved but even whole membranes, and that a good result is only obtained if the wood is cut up very fine and its cells are thoroughly torn. Non-observance of these two conditions was the principal cause of the failure of the previous experiments with sawdust.

Prof. RÜBNER repeated these experiments on a dog, using the same food. He obtained almost the same results. The dog, along with the food ration, also received meat, the digestibility of which was not diminished. The experiments carried out on the dog lead the writer to the conclusion that man is also capable of digesting finely ground birch wood, and he thinks that from 10 to 15 % of rye or meal wheat should be replaced by wood meal in bread manufacture.

3 - Experiments with Dogs in connection with the Mendelian Laws of Heredity. — WELLMANN, O., in *Termeszettudományi Közönségi* (Bulletin of Natural Science), Vol. XI,VIII, No. 4-10, pp. 315-320. Budapest, May 15, 1916.

BREEDING

After first carrying out crossing experiments on mice, fowls and rabbits, the Author in 1909 crossed a black and tan basset with a spotted fox terrier bitch. The experiments which were continued for 5 years, at the Royal Superior Veterinary College of Budapest, sought to determine the inheritance of the colour and shape of the body of the male basset and the fox terrier bitch. The first cross produced 5 individuals of black and tan colour with white spots on the chest and legs, the stature in all cases recalling that of the sire. This fact seems to follow the law of Mendel in the sense that the black and tan colour and the shape of the body of the basset were dominant over the coloured spots and the normal stature of the fox terrier bitch.

Results of black and tan basset cross with fox terrier bitch.

Number of matings	Progeny				Shape of body of fully grown dogs				Died	
	Number	Sex		Colour	black and tan		spotted		blank and tan	spotted
		female	male		basset	fox- terrier	basset	fox- terrier		
2	6	3	3	5	1	4	—	1	—	1
3	5	3	2	2	3	1	—	1	1	1
4	5	2	3	4	1	3	1	1	—	—
5	5	1	4	4	1	—	—	—	4	1
6	11	8	3	8	3	*4	2	1	1	2
Totals . . .	32	17	15	23	9	12	3	4	2	8

Numerical ratio anticipated by theory 24 : 8 11.81 : 3.94 3.94 : 1.31

* very short-legged.

The question is next discussed: What will be the result of intermating the above progeny. If, to avoid confusion, only one character at a time is considered (monohybrid cross), the 1st generation should, according to Mendel's theory, beget black and tan individuals and spotted individuals and individuals with basset stature and with fox terrier stature respectively all this in the ratio 3:1. In the case of the dihybrid cross, the conditions are more complicated, because the different characters are formed into combinations. The writer draws up a table of gametic formulae, in which he collects the 16 theoretical combinations of the determining characters. According to this table there would be formed in the 2nd generation in addition to the 2 parent types, 2 biotypes: the spotted basset and the black and tan fox terrier. The ratio of the 4 biotypes (differing externally) would be such that among the 16 dogs there would be 9 black and tan bassets, 3 spotted bassets, 3 black and tan fox terriers and 1 spotted fox terrier; each biotype would correspond to a homozygous individual.

While demonstrating theoretically what was to be expected from the 2nd filial generation, the writer reports the further course of these experiments: the animals resulting from the 1st filial generation were mated with each other 5 times, and produced 32 individuals: 23 black and tan and 9 of the colour. This result proves that the inheritance of the black and tan colour of the basset and the spotted colour of the fox terrier follows the Mendelian rule, and that the black and tan is always dominant, while the spotted character is recessive. Thus the ratio of the 5 matings (23:9) agrees with the ratio anticipated by theory (24:8).

Of the 32 puppies 11 died, and the remaining 21 grew up well. Of the 21 fully grown dogs there were 16 with basset body (one of them very short-

legged) and 5 with fox terrier body. These results therefore prove that in addition to the basset-shaped dogs there were also in the 2nd generation dogs of normal stature giving practically the ratio which agrees with the theoretical calculation (15.75 : 5.25).

On examining the animals resulting from the 1st filial generation from the dihybrid point of view, experiment proves that the different characteristic features underwent combinations which, in addition to the parent types, produced 2 new biotypes: the spotted basset and the black and tan fox terrier. The appended Table shows the results obtained from the matings.

It will be seen from the Table that, of 21 dogs of the 2nd filial generation, there were:

12 black and tan bassets	3 black and tan fox terriers
4 spotted bassets	2 spotted fox terriers

In conclusion, the Mendelian ratios have for the most part been substantiated: whether the results be considered separately or taken in the aggregate, it is found that the resulting ratios are very close to those calculated by theory.

It is thought that on the basis of these experiments in crossing, dog breeders may build up a theory of hereditary transmission of certain characters peculiar to different breeds of dogs.

224 - Relation between the Quantity of Milk formed and that obtained in Milking. — ZWART S. G., in *Zeitschrift für Fleisch- und Milchhygiene*, 26th Year, No. 15, pp. 231-34; No. 16, pp. 246-250. Berlin, May 1 and 15, 1916.

CATTLE

Agricultural literature contains abundant data in reference to milk and the milk-secreting organs, but few particulars as to the relation between the quantity of milk formed and that obtained in milking. Some experiments were carried out in connection with these questions, the principal results of which are set out in the present work.

According to NIESCH the secretion of milk may be divided into 2 phases; rest period and milking. The rest period is the interval between two milkings; the milking represents the phase during which secretion is promoted by mechanical and physical stimulation, and a distinction is made between preparation and execution of the milking. The first phase depends on the chemical factors of the blood which form the milk, while the second phase depends entirely on nervous influences.

The data relating to the quantity of milk formed during the period of rest diverge greatly. Some contend that the greater portion of the milk is formed during the rest period, while others maintain that it is chiefly formed during milking.

As a result of these experiments the Author is unable to confirm the first opinion as being correct. The arguments put forward by the partisans of the second theory, according to which the quantity of milk drawn from the udder exceeds the latter itself in volume, are also controverted. It was possible repeatedly to inject into the udder the quantity of milk pre-

viously drawn from it. In some cases it was even possible to inject twice the quantity of milk previously drawn from the udder.

It was also sought to determine by exact measurements the quantity of milk formed in the udder. Before milking, *i.e.* at the end of the rest period, the udder contains a quantity of milk made up two parts, *a* and *b*. The part *a* represents the quantity of milk present in the largest galactophorous ducts of the udder (1) and which can be extracted by means of a milking tube, while the part *b* is the quantity of milk contained in the finer ducts and influenced by still other factors (capillarity etc). Part *a* is obtained by putting the milking tube into the channel in the teat. Part *b* is extracted by the Author in the following way: first the milk contained in the main ducts is removed, then the cow is killed, and when the blood has been entirely withdrawn, the teat is removed: it is put into a tureen, cut into pieces and then gently pressed. For this purpose cows yielding from 6 to 12 litres per day were used. The quantity of milk obtained from the small galactophorous ducts varied from 250 to 700 cc.; it averaged 500 cc.

The experiments showed that the milking tube gave a quantity of milk almost equal to that obtained by remilking the cows after this operation. The quantity of milk formed during the rest period is equal to that found in the main ducts plus the contents of the small ducts *before* the preparation for milking. This latter quantity, as said above, averages 500 cc. From this however there must be deducted the quantity of the milk remaining in the udder from the last milking but one: it is always less than 500 cc. The quantity of milk formed during the milking equals the milk obtained by milking after removing the milking tube plus the milk left in the small ducts *after* milking (less than 500 cc.). Although the ratio between these two quantities of milk varies according to the individual and the excitability of the mammary glands, it may be said that the quantities formed during the period of rest and even during milking are equal in normal cows in good condition of lactation.

This rule is not confirmed when the second phase has been produced by stimulations other than those of the milker's hand. In those cases a larger quantity is obtained from the small ducts. This fact suggests that this stimulation, which leads to a downward movement of the milk, is not sufficient in the second phase to get out all the milk which the udder is capable of holding. In order to secure the whole of the milk the teat must be constantly stimulated.

This fact is of immense importance in connection with the use of milking machines. With mechanical milking, the mechanical stimulation is still greater than with hand milking, but even then milk always remains behind in the small ducts. This stagnation of the milk is injurious and hinders the formation of the fluid.

In the following chapter particulars are given of observations on fatten-

(1) The Author means by "largest galactophorous ducts" those ducts the contents of which are influenced by the same forces as the milk in the ducts communicating directly with the main duct.

(Ed.).

ed cows and cow yielding an abnormal milk. It was found that the average quantity of milk obtainable from the udder by milking, after removal of the milk contained in the main ducts was not equal to that previously obtained with the milking tube; the milk which had formed during milking represented 50 % at most of that obtained beforehand with the tube. From the low pressure of the milk in the udder observed after preparing to milk a cow which was developing mastitis, and from the observations of veterinary surgeons to the effect that some diseases of the udder are manifested by a reduction of the yield of good milk several days beforehand, the conclusion is drawn that somewhat abnormal glands are quite well able to form the milk of the first phase, but are inadequate to produce the milk of the second phase with sufficient rapidity. If the milk does not go down, or if it takes some time to descend, or if it descends in a smaller quantity than usual, it may be concluded that the cow is contracting mastitis, unless the reduction of the milk yield is due to nervous influences.

To illustrate the mode of formation of milk, the Author represented by curves the quantities of milk obtained by fractional milking of several cows. He was thus able to show that towards the end of milking more milk is drawn than is formed, so that after some time it is not possible to draw any more milk from the udder; the cow is then completely milked.

Experiments were also conducted with a view to determining the quantity of milk contained in the main duct and in the teat canal. In this case also the data contained in the literature of the subject diverged. It was formerly generally believed that the main duct always contains a large quantity of milk, but latterly the statement sometimes appears that the main duct and canal of the teat do not contain milk during the period of rest. The writer was able to ascertain, in the case of about 100 cows, that all normal teats contained milk in their duct, and that the most swollen teats contained the smallest quantity of milk.

The fact that during the period of rest the milk does not pass out of the teat is due to the veins which swell and shut off the exit. Therefore milking is only possible when the blood has been expelled from the veins by specific excitation.

The teat canal never contains milk during the period of rest.

Effect of Water in the Ration on the Composition of Milk. — TURNER W. E., SHAW R. H., NORTON R. P., and WRIGHT P. A. — *Journal of Agricultural Research*, Vol. VI, No. 4, pp. 167-178. Washington, D. C., April 21, 1910.

Experiments conducted at Brownsville, Tex., by the Dairy Division of the Bureau of Animal Industry, U. S. Department of Agriculture indicate that the feeding of prickly-pear (*Opuntia* spp.) lowers the percentages of fat in milk. In comparison with other feeds, prickly-pear contains a large amount of water and mineral matter. It was thought by the writers that one or both of these constituents might be responsible for the reduction in fat percentage; consequently experiments were conducted to determine the influence of the water; work on the mineral matter is in progress. The literature dealing with the effects of watery feeds or water in the ration upon the quantity of milk produced is reported to con-

tain much contradictory evidence. The difficulty of eliminating all factors except the watery character of the ration is believed to be largely responsible for the conflicting nature of the statements.

The experimental work to determine the effect of water upon the composition of milk was conducted at the Dairy Division farm, Beltsville, Md., and included three different lactation periods. The four following methods for supplying rations of widely different water content were tried: a) a full allowance of drinking water as compared with a limited supply, the ration being alike in both cases; b) a heavy ration of turnips as compared with one of dry forage; c) wet beet pulp as compared with dry beet pulp; d) green crimson clover (*Trifolium incarnatum* L.) as compared with the cured hay. Eight cows were used in the experiments conducted by the first method, four in the second, two in the third, and four in the fourth.

In every case except when the crimson clover was fed the amount of water drunk by the different animals as well as the difference in the water content of the forages under comparison, was determined.

With all except one cow in the wet versus dry beet-pulp group, the amount of water in the dry ration did not exceed 75 per cent. of that supplied by the wet ration, and with some cows that were given a limited allowance of water the dry ration contained less than 60 per cent. of the water content of the full-allowance ration. One cow in the wet versus dry beet-pulp group received, when the dry ration was fed, 88 per cent. of the water content of the wet ration.

In the green versus cured crimson-clover group, the former contained 71.23 per cent. water and the latter 8.33 per cent. The daily ration of green clover varied from 40 to 50 pounds per head, and of the cured hay from 16 to 22 pounds per head.

Certain individual cows at times produced milk having an abnormal fat content. This effect was apparently independent of the ration, as it occurred not only with the high water-content ration but with the dry as well. A study of the data obtained in the four series shows that the watery character of the ration has no effect upon the fat content of the milk. There was even less variation in the other milk constituents than in the fat. This indicates that rations of varying water content have no effect upon the composition of milk.

13 references bearing on the subject are quoted.

886 - **The Value of Maize Silage, Fed in Big Rations, in the Feeding Economy of Cattle.** — ALLISON H. O., in *The Breeder's Gazette*, Vol. LXIX, p. 1068. Chicago, May 1910.

The agricultural test farm of Colombia (University of Missouri) recently sold on the Chicago market 5 lots each comprising 6 head of butcher cattle fattened with different quantities of concentrates (maize, linseed and cotton seed cakes), ensilaged maize forage, and lucerne hay *ad lib.*

The following results bring out clearly the value of ensilaged maize in the feeding economy of fattening oxen, according to the prices per bushel quoted on the market for the foods used: maize, 70 cents; maize silage, \$ 4.50; cotton seed meal, \$ 37; linseed oil meal \$ 37; lucerne hay \$ 1.

er ton. The maize silage came from a crop which would probably have yielded about 60 bushels of grain per acre and in which the growth of straw was considerable.

The cattle were choice Herefords, bought in the market of Kansas City in such a way as to ensure the greatest possible uniformity, and cost £7.64 per cwt. delivered at the farm. After fattening in winter for a period of 133 days, they showed the following increase of weight :

	Lot I —	Lot II —	Lot III —	Lot IV —	Lot V —
verage initial weight per head, lbs.	925	923	938	926	912
verage final weight per head, lbs.	1286.94	1249.44	1199.77	1243.05	1206.66
verage increase per day per head, lbs	2.721	2.454	1.068	2.383	2.140

Consuming per day per head the following average quantities of food (in lbs) :

	Lot I —	Lot II —	Lot III —	Lot IV —	Lot V —
maize	15.597	15.242	—	—	15.274
cotton seed meal	2.600	—	5.055	—	—
linseed oil meal	—	2.540	—	5.055	—
maize silage (ad lib) . .	17.468	16.466	36.222	37.620	16.263
lucerne hay (ad lib) . .	3.687	2.267	3.001	4.027	3.897

The economic result of fattening, according to the market prices of the above foods, was as follows :

	Lot I —	Lot II —	Lot III —	Lot IV —	Lot V —
cost of increased weight, per 100 lbs.	10.42	10.58	10.15	8.57	10.88
elling price in Chicago	9.60	9.75	9.65	9.65	9.75
verage net profit, per head.	6.77	9.32	6.87	14.56	10.53

The highest profit coincides with the minimum use of concentrates and maximum consumption of ensilaged maize and lucerne hay, while the maximum daily increase coincides with a minimum of profit due to a large presumption of concentrates.

— Scale of Points adopted by the "American Jersey Cattle Club" — Missouri State Board of Agriculture Monthly Bulletin, Vol. XIII, No. 11, pp. 56-57; Columbia Mo. November 1915.

The following scale of points has been adopted by the American Jersey Cattle Club for scoring for Jersey Bulls and Cows :

*Score of Jersey Bull.**Head, 10:*

- A — Broad, medium length ; face dished ; narrow between horns ; horns medium in size and incurving
 B — Muzzle broad, nostrils open, eyes full and bold ; whole appearance vigorous and masculine without any indecision

Neck, 7 :

- Medium length, with full crest at maturity ; clean at throat

Body, 57:

- A — Shoulders full and strong, good distance through from point to point, with well-defined withers ; chest deep and full between and just behind the forelegs
 B — Barrel long, of good depth and breadth, with strong rounded, well-sprung ribs
 C — Back straight and strong
 D — Rump of good length and proportion to size of body, and level from hip bones to rump bones
 E — Loins broad and strong, hip rounded, and of medium width compared with female
 F — Thighs rather flat, well cut behind high arched flank
 G — Legs proportionate to size and of fine quality, well apart, with good feet and not to weave or cross in walking

Rudimentary Teats, 2 :

- Well placed

Hide, 2 :

- Loose and mellow

Tail 2 :

- Thin, long, reaching the hock, with good switch, not coarse or high at setting-on

Size, 5 :

- Mature bulls, 1200 to 1500 pounds

General Appearance, 15 :

- Thoroughly masculine in character, with a harmonious blending of the parts to each other ; thoroughly robust, and such an animal as in a herd of wild cattle would likely become master of the herd by the law of natural selection and survival of the fittest

*Score of Jersey Cow.**Head, 7 :*

- A — Medium size, lean ; face dished ; broad between eyes ; horns medium size, incurving
 B — Eyes full and placid ; ears medium size, fine carried alert ; muzzle broad, with wide open nostrils and muscular lips ; jaw strong

Neck, 4 :

- Thin, rather long, with clean throat, neatly joined to head and shoulders

Body, 37 :

- A — Shoulders light, good distance through from point to point, but thin at withers ; chest deep and full between and just back of forelegs
 B — Ribs amply sprung and wide apart, giving wedge shape, with deep, large abdomen, firmly held up, with strong muscular development
 C — Back straight and strong with prominent spinal processes ; loins broad and strong
 D — Rump long to tail-setting, and level from hip bones to rump bones
 E — Hip-bones high and wide apart
 F — Thighs flat and wide apart giving ample room for udder
 G — Legs proportionate to size and of fine quality, well apart, with good feet and not to weave or cross in walking
 H — Hide loose and mellow
 I --- Tail thin, long with good switch not coarse at setting-on

Mammary Development.

<i>Udder, 20 :</i>	
A — Large size, flexible and not fleshy	6
B — Broad, level or spherical, not deeply cut between teats	4
C — Fore udder full and well rounded, running well forward at front teats	10
D — Rear udder well rounded and well out and up behind	6
<i>Udder, 8 :</i>	
Of good and uniform length and size, regularly and squarely placed	8
<i>Udder, 4 :</i>	
Large, long, tortuous and elastic, entering large and numerous orifices	4
<i>Udder, 4 :</i>	
Mature cows 800 to 1000 pounds.	4
<i>General Appearance, 10 :</i>	
A symmetrical balancing of all the parts, and a proportion of parts to each other depending on size of animal, with the general appearance of a high-class animal, with capacity for food and productiveness at pull	10
	100

18 - Progress of Guernsey Cattle in the United States according to Particulars of the "American Guernsey Cattle Club". — CADWELL W. H., in *Hoard's Dairyman*, Vol. LI, No. 18, p. 742, Fort Atkinson, Wisc., May 26, 1916.

On examining the work carried out during the last working year of the American Guernsey Cattle Club, ended 29th April 1916, one fully realises the progress accomplished in the development of this dairy breed in the United States, and above all the continuous increase in the average production as it appears from the "Advanced Register".

The register of bulls contains 37 862 head, and that of cows 63 954 head, making a total of 101 816.

Five years ago there were only 44 286 animals registered, which shows that during the last five-year period, the Herd Register exhibited an increase of 130 %. As the importation of thoroughbred Guernseys since 1840, according to the best sources of information, was only 466 bulls and 7 121 cows, it follows that the importations were only 7.5 % of the number of these animals at present alive ; this proves how prolific the breed is in the United States.

There were issued 4 198 certificates of registration of Guernsey cows in the Advanced Register ; 949 of these cows were registered during the last working year which makes an increase of 90 % as compared with the preceding year.

The average production of 4 719 records tested is at present 8805.91 lbs. of milk and 439.15 lbs. of fat. During the last year this average rose 1132.18 lbs. for milk and 5.24 lbs. for fat.

There are at present under test 1 173 cows, belonging to 270 breeders in 28 States ; 70 % of these breeders, or 190, have 854 of these cows (72 %) after the 2 days' test. There are also 18 superior State Schools of Agriculture which keep Advanced Registers for their own dairy herds.

to Guernsey cows entered in the Advanced Register have a four-years average of 11915.7 lbs. of milk and 630.93 lbs. of fat.

The Club numbers 530 members, of whom 64 joined last year.

Its capital is about \$216 251 63 and its expenditure last year \$83 272 07.

889 - **Pig Breeding and Intensive Maize and Soya Pasturage, in the United States.** ~
BEAVERS J. C. (Purdue University), in *The Breeder's Gazette*, Vol. LXIX, No. 22, pp.
1160-1161. Chicago, June 1, 1916.

The importance of combining soya with maize in connection with pig breeding is clearly brought out by the facts collected by this writer and due partly to actual practical work and partly to the breeding tests carried on for Purdue University.

From the food trials it has been found that 8.8 lbs. of maize plus 2.4 lbs. of soya are equivalent, for pig fattening, to 15.2 lbs. of maize alone. By combining soya with maize, an intensive pasturage for pigs is obtained, by which the maximum of unit yields may be secured. The following are, in brief, the increases of weight obtained per acre during the experiments and those yielded in practice, together with the rules for combining the two feeds.

Carroll Co. (Indiana). — A plot of 5 $\frac{1}{2}$ acres put down to maize combined with soya was reserved for pasturing 99 pigs averaging 108 lbs. weight each, for a period of 27 days and gave a total increase of live weight of 5 288 lbs. or 2 lbs. each per day. The presumable crop of maize would have been about 70 to 75 bushels per acre, and that of soya 12 to 14 bushels.

Clarke Co. — A plot of 2-3 acre in 15 days produced an increase in weight of 1210 lbs., or 526 lbs. per acre, in 34 pigs, plus a further increase of 7 lbs. obtained with some sows by utilising the pasturage residues. In all live weight increase of 600 pounds per acre resulted. The anticipated crop would have been about 45 bushels per acre.

In the trials of combining soya with maize the average yield obtained was as much as 61 bushels total grain per acre, and the yield of maize was most always higher on the parts where it was combined with soya than those where it was not. In two cases, with non-inoculated soya seeds, there was a yield markedly unfavourable to the combination, owing to the fact that the soya, being almost completely devoid of root nodules, deprived the maize of a good proportion of the soil nitrogen.

For ensilage the combination of soya with maize is also preferable to maize alone. The many trials carried out yielded, on the average, an increase of 2521 lbs. silage per acre over the yield of maize grown alone; wet years, an average increase of 3600 lbs. per acre in favour of the combination. Moreover, the resulting forage is richer in protein substances than maize forage alone.

Putting pigs out to pasture forms in turn the best mode of turning the crop to account and many experiments, borne out by practice, have proved that the successive growing for several years of maize together with soya on the same plot, with the object of feeding the standing crop to pigs does not noticeably reduce the fertility of the soil, because, in addition

the manuring, a large quantity of organic substance is left on the soil, which is incorporated in the latter by ploughing and promotes fertility.

The combination of soya with maize demands the choice of varieties of soya which mature at the same time as maize, principally in those cases where, to reduce expenses, sowing is done simultaneously. In the United States, in the maize zone, between the 38th and the 41st degree of latitude, the Hollybrook variety possesses this quality.

Three methods of sowing soya are at present in use : 1) some farmers provide the maize sower with special boxes for soya, in order to sow them together ; 2) others mix the soya with dry sifted soil, and distribute the seed with the manure spreader of the maize sower ; they usually put down 12 lbs. per acre of soya seed and 65 lbs. of soil when the manure spreader is adjusted to 75 lbs. per acre; 3) others sow the soya separately after maize, going over the furrow twice, but this method is more expensive. The quantity of 12 lbs. per acre represents approximately 3 or to 4 soybeans to each row.

90 - On the Value of Lime in Relation to Silkworm Nutrition. — HATANO IWARICHI, in *Bulletin de l'Association séricole du Japon*, Year II, No. 4, pp. 1-4. Tokio, March 1, 1916.

SERICULTURE

For his experiments, the writer used silkworms of the Koishimaru race having but one generation a year. He reared them on the ordinary method up to the end of the 4th moult. At the time of the 5th moult he formed 4 groups of 500 worms each, which he fed with leaves treated : 1) with a solution of calcium bicarbonate ; 2) with a solution of calcium chloride ; 3) with a solution of calcium acetate; the 4th group was fed with untreated leaves (control). All the solutions were of 5 % strength. The solution was spread on the leaves in a very fine spray, to the amount of 4 centilitres per 100 mommé (375 gr.) of leaves. When dried the leaves were given to the worms.

On the whole, the worms fed on leaves treated with lime salts grew much more than those of the control group, as is shown by the following weights (in grams) :

Groups	100 adult worms	100 live cocoons	100 silk cocoons	100 chrysalids	100 cast skins
1st	211.35 gr.	160.53 gr.	23.25 gr.	142.42 gr.	0.87 gr.
2nd	217.00	167.23	23.80	142.44	0.88
3rd	217.94	164.11	23.47	141.76	0.88
ab control . . .	196.81	157.34	22.18	134.38	0.76

The weight of the dried bodies of 100 mature worms, with the intestine entirely emptied, in the case of the groups fed with lime salts exceeded by 4 to 8 grams that of the dried matter of the control group. The weight of the dried matter of 100 live cocoons exceeded that of the control group by 3 to 4 gr., made up as follows :

Silk cocoons	1 to 1.5 gr
Chrysalids	2 to 2.5
Cast skins	0.07

The percentage of dry matter was also 8 to 15% higher than that of the control group in the mature worms, and 5 to 7% in the dry cocoons and the silk cocoons.

The weight of calcium contained in the groups under experiment exceeded that of the control group in all cases, both in the mature worms and in the silk cocoons; in the larvae the excess was 25.14% in the calcium acetate group, while it was lower than this, namely 3.07 and 11.93% respectively, in the calcium bicarbonate and chloride groups.

The investigations will be continued in order to ascertain which lime salt is most favourable to the growth of the worms and in what degree of concentration.

It is finally pointed out that according to an analysis by NAGAKA MUNEYOSHI the ash of the ripe Japanese mulberry leaf contains:

Phosphoric acid	12.02%	Sulphuric acid	4.65%
Potash	31.47	Chlorine	0.06
Soda	3.16	Silicic acid	1.45
Lime	33.35	Oxide of iron	1.59
Magnesia	12.48		

Lime is therefore present in a proportion almost three times that of magnesia; this excludes the possibility of its beneficent action on the larvae being due to an antagonism to the action of magnesia, similar to that observed in plants.

891 · Study of Sericulture in Madagascar. — in *Bulletin économique de la colonie de Madagascar et dépendances*, Year 15, No. 1, pp. 1-17, Tananarivo, 1st Half Year 1915.

Before the French occupation, the silk used by the natives was obtained exclusively from *Borocera madagascariensis*, occurring very widely in the central and western parts of the island and on a considerable number of plants. It sometimes becomes a positive pest in the mimosa plantations. It is still regularly reared on the "tapias" (*Upaca clusiacea*) which exist in more or less dense forests on the lateritic hills. The "tsitoavina" (*Dodonea madagascariensis*) and the "ambrevade" (*Cajanus indicus*) are also reared. In the regions of Majunga and Maintirano, *Borocera* lives wild in the *Rhizophora* forests of the coast and the natives gather cocoons at certain periods of the year.

There are other wild native larvae belonging to certain silk-bearing species of *Bombyx*; namely *B. Radama* and *B. Diego*. They are found in almost all the forests of the eastern slope and the North. The caterpillars have the peculiar feature that they enclose their cocoon in a large envelope which they weave in common and which is sometimes 1 metre in length. Since the French occupation, especially since 1900, the silk industry in the island has been based on the rearing of *Bombyx mori*.

After dealing with the cultivation of the mulberry tree 1) and the technical conditions of silkworm breeding 2), some information is given on the

(1) See *B.* March 1913, No. 267.

(2) See *B.* June 1914, No. 555.

roduction of silkworm eggs, cocoons and silk, and finally an account of government encouragement afforded to sericulture and the future in prospect for this industry in the island.

The Nanisana station annually prepares from 300 to 350 thousand layers of moths, which are distributed free to European and native rearers.

In the Centre of Madagascar the cocoon has retained the classical form of the good French cocoon. As regards their size above all and the quality of the threads, the Madagascar cocoons are comparable, according to competent authorities, with the cocoons of the Cévennes. The experiments tried out at the Public Silk Conditioning Establishment in Lyons and by several spinners in the South of France and the North of Italy plainly show that the silkworm races of Madagascar when subject to continuous and methodical selection can furnish cocoons at least as rich in silk as those of European breeds.

The raw silk is comparable in all points with the good raw silk of Piedmont and the Cévennes.

The local government, in addition to free distribution of the eggs produced by the station of Nanisana, has distributed more than 200 000 rooted mulberry plants. The "cultivation agents" attached to the public departments demonstrate to those concerned the conditions of silkworm rearing. Finally, premiums are distributed for cocoons at the rate of 3d. and $1\frac{1}{2}$ d. per kg. (2.2 lbs.) according to quality.

With regard to spinning, the decree of the 21st July 1910 allows an annual premium for a period of 10 years from the 1st January 1911, of 1 franc per degummer working with more than 3 ends; another premium of 400 francs is granted for additional degummiers at the rate of one additional degummer to every three working with more than 3 and less than 9 ends, and at the rate of one accessory degummer per two degummers working with more than five ends.

- Researches on the Digestibility of Different Foods used for Rearing Young Fish. — WOHLGEMUTH RICHARD, in *Allgemeine Fischerei-Zeitung*, Year 1913, No. 18, pp. 271-275. Munich, 1913.

At the Bavarian fish-breeding Station of Wielenbach, the Author tried out feeding experiments in order to determine the digestibility of different foods for fry. For this purpose he employed rainbow trout fry of old and of normal development. In order to produce like conditions food under study was always given in the morning, 12 to 14 hours after last meal, so that the fry, under the stimulus of hunger, regularly ate the ration. The natural food was generally eaten within a few minutes; the ration was always abundant, and the part uneaten was afterwards rejected. After half an hour at least the fish were taken out and studied from the point of view of food digestion. The term "digestion completed" means that the stomach is left quite empty or contains only indigestible remains. Each time at least 10 fish together were taken.

The following were the foods studied:

1) Spleen: It was carefully freed from skin, then forced through a sieve to remove all the tougher portions. Before giving it to the fry it

was cut up into small pieces. Two hours afterwards the fish showed a well filled stomach, but no signs of digestion as yet : 4 hours afterwards, signs of digestion were evident ; 5 hours afterwards the contents of the stomach were less in quantity ; 6 hours afterwards 2 fish had their stomachs empty, and ; hours afterwards digestion was completed in all the fish. The conclusion drawn is that the spleen is digested 6 to 7 hours after feeding.

2) *Liver* : Same preparation as for the spleen. Its digestibility is very different. Some fish were found with their stomachs empty as little as 6 hours afterwards, while in others digestion was only completed 8 hours afterwards. Generally it may be said that digestion is terminated within 7 to 8 hours.

3) *Fish flesh* : The flesh of freshwater fish was given either separately or together with spleen, liver and shrimps to older fry. The fish used for preparing the food were put into hot water and left there from 1 to 3 minutes according to size ; they were then pressed in moulds after removing the skin and bone from the biggest.

Three hours after the meal, the stomach of the fry was still quite full 4 hours afterwards digestion was begun, and 6 hours afterwards all the fish had their stomachs empty. The conclusion drawn is that the flesh of fish is completely digested 5 to 6 hours after the meal.

4) *Shrimps* : Shrimps also were only given during the period previous to the stocking of the pond with fry. The shrimps were first left in boiling water for half to three quarters of an hour, then pressed in moulds. On fry which have reached a certain age readily eat shrimps alone ; for young fry they must be mixed with soft substances such as liver, spleen etc. First 50 % of shrimps are mixed with 50 % of liver, etc. Then in proportion as the age of the fry increases the proportion of shrimps is increased, until finally shrimps alone are fed to them.

In the case of the fish receiving shrimps alone digestion was completed 5 to 6 hours after the meal.

(5) *Larvae of Culex pipiens* : These were eaten by the fry within few minutes : 1 $\frac{1}{2}$ to 2 $\frac{1}{2}$ hours after the meal digestion was begun. The writer counted a maximum of 18 larvae in the stomach of one fish. Digestion was terminated 4 to 5 hours after the meal. An interesting fact is that the chitinous parts of the larvae remain in the stomach of the fish for a very long time, probably owing to derangements impeding the peristaltic movement of the stomach. The same fact is observed when *Daphnia* are given.

(6) *Daphnididae* : The larvae of *Daphnia magna* and *Daphnia pulex* were given. They were immediately devoured by the fish, which ate about 20 per head per meal. The first signs of digestion were observed 2 $\frac{1}{2}$ hours after the meal, and digestion was completed 3 $\frac{1}{2}$ to 4 $\frac{1}{2}$ hours after the meal.

Conclusions. — Liver requires twice as long as shrimp for digestion. Liver and spleen require most time, the natural food (*Culex*, etc.) requires the least time. Fish-flesh and shrimps are intermediate between the two groups with regard to the period of digestion. The causes of the

digestion of the natural food are : (a) the large surface presented by the larvae as a whole, which enables the gastric juice to attack the food thoroughly ; (b) the loose consistency of the food in the stomach of the fish ; (c) the gastric juices of the larvae etc., which contribute to digestion in the stomach of the fish.

It follows from the above that the natural food is the best for the fry of Salmonids. To the youngest fry, spleen can also be given when the natural food is wanting. When the fry reach a certain age a ration may be given them consisting of spleen plus fish-flesh, or spleen plus shrimps, or again fish-flesh alone. The mixture fish-flesh plus shrimps also gave satisfaction with, somewhat older fry.

§93 - Fish Breeding in Switzerland in 1915. — Bulletin suisse de Pêche et Pisciculture XVIII year, No. 5, pp. 59-63. Neuchâtel, May 1916.

As during the preceding year (1), 212 establishments were carried on during the incubation period 1914-1915. 128 857 000 fry hatched out from 36 696 000 incubated eggs. Including 63 239 small fish of one summer or ne year, 127 694 239 fry were put into public waters under federal supervision. The appended Table gives particulars of the fry resulting from the incubated eggs.

Number of larvae hatched out.

A. — Native species.

Salmon	1 337 000
Salmon trout, hybrid	34 000
Lake trout	2 655 000
River and stream trout	9 168 000
Char.	4 456 000
Grayling	2 632 000
Coregonus	97 244 000
Pike	10 766 000
Perch	130 000
Carp.	205 000

B. — Exotic species.

Rainbow trout	284 000
American char	0 000
Total	128 857 000

The Confederation paid to the cantons, for transmission to the fish breeders in question, a subsidy of nearly £ 1400 (nearly £ 1500 in 1914) for the

(1) See B. 1914, No. 1038.

(Ed.)

incubation of the eggs and the transfer of the fry to public waters. The canton of Valais is not comprised in the above figures, as the establishments in that canton did not make any application with a view to obtaining a federal subsidy. No fish breeding was carried on during that year in the canton of Appenzell Rh. Int. The Swiss fisheries and fish breeding Society received a federal subsidy of about £ 120. Similarly to other riparian States, the Swiss Confederation made a grant of £ 12 to the International Union of Fishers of the Lake of Constance, for the expense of stocking that lake in 1915. In the same year Swiss fishermen took from that lake, including the lower lake, 331 573 lbs. of fish of a value of over £ 9800 (in 1914, 322 443 lb of a value of over £ 9284).

The number of fishery guards in the service of the cantons was 161 during the year 1915, aided temporarily by 19 assistants. These agents received, by way of salary, attendance and travelling allowances, a total sum of £ 4363 (£ 4262 in 1914), of which the Confederation took upon itself £ 2182 (£ 2131 in 1914), or 50 % in accordance with the law. The cantons also expended £ 18 (£ 21 in 1914) for the destruction of animals injurious to fisheries, but the Confederation refunded about £ 15 (£ 9 in 1914).

A course of instruction was given in Lucerne from the 22nd to the 27th February for water bailiffs.

Fish ladders were established in the vicinity of various works (August-Wylen, Laufenbourg) along the Rhine, as well as near the hydraulic power stations of Perlen, in Reuss. Refuges for fish have, in accordance with the instructions of the Swiss Home Office, been built along the altered bed of the Wina, between Reinach and Gotenschwil, on account of the reclamation of the marshes there.

The federal legislation on fisheries has undergone no change. The regulations of the 2nd May 1913 on fishing in the boundary waters between Switzerland and Italy was slightly modified by decree of the 2nd July 1915.

894 - Cross between a Wild and a Domesticated Fur Rabbit in order to obtain a Good Fur. — ZIMMERMANN R., in *Berliner Tierärztliche Wochenschrift*, Year, 32, No. 12, p. 213. Berlin, May 4, 1916.

For some years past experiments have been carried out in Germany by the writer with a view to obtaining a rabbit combining the following three qualities: (a) a fur superior to that of the common domesticated rabbit (b) good meat; and (c) high resistance to disease. The results hitherto have been as follows.

1) By crossing a wild male (grey coat) with a female of the French silvered breed (black coat with a few white hairs) and a female of the German breed "Edelweiss" (Albino), the offspring were 10 in number, 4 males and 6 females. All the 10 offspring were grey in colour and their physical conformation was that of the wild sire, but they were bigger. Their meat is lighter but clearly suggests the wild meat. The fur is more supple than that of the sire.

The writer still has 1 male and 2 females of this litter; the other animals were either sold to breeders or killed. These 3 individuals have retained the timidity characteristic of the wild rabbit.

2) A grey male obtained by crossing a wild male with a French silvered female was crossed with the German female "Edelweiss"; the progeny numbered 4 : 2 black and 2 grey. Of these latter there are still 1 black and 1 grey individual, both having reached half the normal growth. The black rabbit already shows white hairs in the black coat, thus recalling the silvered granddam. These 2 subjects have supple fur, but they still possess the timid character of the wild rabbit.

3) The second litter from the above cross consists of 4 animals now aged 5 weeks, 3 of them being black and 1 grey.

4) On crossing a male rabbit with a female of the same litter originating from the cross wild male \times French silvered female, a litter was recently obtained which has not yet been studied, but which meanwhile already discloses the interesting fact that the mating of the parents of this litter, who are brother and sister, is fertile.

93 - **Gum Lac and the Breeding of *Tachardia*.** — 1. DUPORT L. L'Insecte à Stick-lac. II. HAUTEFEUILLE L. La gomme laque et son traitement industriel, in *Bulletin économique de l'Indochine*, Nos. 112 and 116, pp. 182-189 and 872-994. Hanoi-Haiphong, March-April and November-December 1915.

This study contains a summary of ten years of research and observations carried out by M. HAUTEFEUILLE. The stick-lac insect, *Tachardia lacca* R. Bl., known also under the names of *Carteria lacca* Sig. and *Coccus lacca* Kerr. is one of the rare useful cochineal insects; it produces gum lac and also a red colouring substance termed lac dye by the English.

In India, where this product is very important, several species of *Tachardia* are probably known, or at any rate several varieties of *Tachardia lacca*, which explains the contradictions in the information supplied by different authors. DUPORT describes the insect, giving general information as to its life history, with a separate description of the female, the male, and the method of reproduction. He also enumerates the enemies of *Tachardia* and among others: ants, the larval forms of Noctuidae and Tineidae, and some Hymenoptera belonging to the family of Braconidae and Chalcididae.

HAUTEFEUILLE next studied gum lac and its industrial preparation. Gum lac should not be confused with lac of vegetable origin derived from *Flueggea vermicifera* in Tonkin. Gum lac is a half-waxy, half-gummy secretion of an insect living in innumerable colonies on some plants in India. It has many important industrial uses, and the trade, as shown by the tables appended to the paper, attains considerable proportions. India exported, on the average, during the 11 years 1903 to 1914, 17 736 tons per year of an approximate value of about £ 356 641 at a unit price of 11.68 d. per pound. Indo-China during the period 1906-1914, exported on the average 1 092 249 lbs. per year, for £ 24 190, at the average unit price of 5.67d. The range of the lac insect lies within a vast rectangle enclosing Tonkin and the northern tracts of British India. *The Dictionary of Economic Products of India* by G. WATT gives the list of the plant species on which the lac insect is able to live; this list is reproduced by the writer with the addition of some further species reported by the Forestry Department of Assam. This

list comprises among others *Acacia arabica* and *A. catechu* and the genera *Albizia*, *Butea*, *Ceratonia*, *Ficus*, *Erythrina*, *Tectona* and *Zizyphus*.

Ricinus communis is included in the list given by the Assam Forestry Department. The principal species, however, on which colonies of *Tachardia* are usually found are chiefly *Butea frondosa*, *Cajanus indicus*, *Ficus religiosa*, *Zizyphus jujuba* and finally *Schleichera trijuga* which supplies the best gum lac.

The writer reproduces the principal passages of a study by MAXWELL, LEFROY on the lac insect *Zizyphus jujuba*. This insect has two generations a year. The eggs hatch in June and the insects develop until the end of September-October, when oviposition takes place. This second generation completes its life cycle about the end of May. The trees require to be cut in time, as it is important that the insects should be inoculated into strong shoots with abundant sap, but the bark of which can be easily attacked by the rostrum of the insect. Inoculation is effected by taking a piece of gum lac in which the eggs are about to hatch ; this is placed between two plates of bamboo and tied to the shoot of the tree or shrub on which the rearing is carried out. The emergence of the insects soon takes place, and in proportion as they are hatched they range themselves round the parent or original gum lac, going up the branch on which they were placed. It is important that they should not be allowed to mount up too near to the end, where they would not find sufficient food. As soon as the insects have discovered a favourable point to insert their rostrum, they lose their legs in a first moult, and if they are females they become motionless until the end of their life-cycle. The males on the contrary, whether winged or wingless, leave their scale within a few weeks and mate, but die soon afterwards. The females, when once they have been fertilised, become gradually mature and then commence oviposition, which weakens them gradually until death ensues. The resin is formed between the time of fertilisation and that of oviposition ; during this time the female projects out of her resinous coating white waxy filaments which give the colony a white downy appearance denoting its good state of health. According to MAXWELL, the wild jujube tree is particularly adapted for this type of rearing ; a plant in good condition and well inoculated should yield about 22 lbs. of lac.

These insects usually have two generations in India. They are said nevertheless to have three generations in the province of Madras, Mysore and Burmah. MR. STEBBING, zoologist to the forestry department of India, advises the establishment of special plantations of the species on which the insect lives best, and he adds that the colonies ready to swarm should only be taken from trees of the species on which it is intended to settle the insect, or in any case the colonies should have lived on harder species than those on which it is proposed to settle them. The branches bearing the future swarm must be cut so that the larvae do not swarm during transport and the sap in the branches themselves does not dry up, which would cause the death of the females before the maturity of the eggs.

Comparative data are supplied with regard to the production of Indochina and India. The stick lac of India is more friable than that

Indochina. Generally, Indian lac fetches better prices than Indo-chinese, although the latter is in turn well quoted on the market, and regarded for instance as superior to that of Siam. It is particularly appreciated owing to its purity and the absence of any resin.

For the production and collection of the lac, it is pointed out that the natives have always seemed astonished to hear of crops being obtained from the forest; they assume that its production can only be obtained on plants specially cultivated for the purpose. Nevertheless, lac of Indian origin is often described as forest produce. No data are available to clear up this question. With regard to the cultivated plants, some of them are able to supply two crops per year for two or three consecutive years even, but generally a rest period of one year, or at least of one crop or two, is required.

The memorandum next supplies information with regard to the geographical range of *Tachardia* and the experiments carried on to extend its production. It is interesting to note that the most suitable spots for production should not be either too hot or too cold, the rainfall amounting to 19.25 inches per annum, humidity should not be wanting but must not be excessive; dry and arid tracts must be rejected. The observations made in Indochina give from 1310 to 2130 feet as the limits of altitude. A temperate climate and places sheltered from the wind, but airy and hilly, seem the best.

The writer has collected the data supplied by the experiments made or spreading the insect in Indo-China and he describes the means employed in Indo-China and India for purifying lac. Summarising afterwards the results of his researches and excursions, he records that production in Indo-China is carried on in three regions only: those of Sonla, Song-Ma and Nam-Hon. He recalls the fact that the production of lac requires thorough aeration and the presence of a species of big light red ant, which according to the natives is to be credited with combating all other ants injurious to rearing, the latter being easily recognised as they are black and small. Finally, there is published a scheme of research intended to complete the geographical distribution of producing areas, to specify more clearly the nature and distribution of the most useful species, to study the different kinds of lac produced and the reasons why some lots are insoluble in alcohol, and to extend the cultivation of *Schleichera trijuga*, which is also useful owing to its edible kernel rich in oil, but which is above all recommended for the production of the best known in trade as "Fine Orange".

According to the writer the researches should also extend to the entomological study of *Tachardia*, the economic conditions of its rearing, the sale and exchange of eggs, the study of the ant regarded as useful and the conditions and requirements of the various markets.

Finally, the report comprises two plants representing the plant and appliances required for the refining of gum lac.

CULTURAL
MACHINERY
INDUSTRY
EMENTS

FARM ENGINEERING.

896 - **Electric Tillage in the Province of Piacenza, Italy.** — *L'Italia Agricola*, 53rd Year,
No. 3, pp. 120-121. Piacenza, March 15, 1916.

In the province of Piacenza, tillage by electricity supplied by cable has been carried on for about 3 years over enormous tracts of land, and the work thus executed in 1915 has proved that the problem of this tillage is on the way to being finally solved.

The machinery employed for this work by the BRIOSCHI Electrical Undertakings Company yielded satisfactory results everywhere, both in regard to the depth and the regularity of ploughing.

With 2 plough shares working a strip 26.5 inches wide to a depth of 13.8 inches at an average speed of 47.3 inches per second, the machine ploughs 10.76 sq. ft. per second, allowing for stoppages at the headlands, its normal output may amount to 7.41 acres per day of about 11 hours' work.

The winch is actuated by an 80 H. P. electric motor, the usual consumption being only 60 to 70 H. P. Being fed direct by the feed mains with 3600 volts, it can be placed at any point of the system. The feed current is transmitted to it by a flexible cable covered with a metal tube, which follows the winch in its forward movement. Owing to special terminals the current can be switched on or switched off at any moment when the main are under load. The staff required does not exceed 3 men : one at the winch, one at the plough, and one at the transmission carriage by which the reciprocating movement of the plough is produced, these three parts of the machine being kept in alignment so as to facilitate supervision and checking of the work.

897 - **Mechanical Tillage Experiments with Tractors at York, England, in 1915.** — G. E. CHRIST J., in *The University of Leeds and The Yorkshire Council for Agricultural Education*, No. 100, *Report on Demonstrations with Motor Tractors at York*, 1915, 24 pp., 1 tables + plates. Leeds, 1916.

In agreement with the University of Leeds and the Yorkshire Agricultural Education Committee, the Yorkshire Agricultural Society had demonstrations of tractors and cultivation machines carried out in November 1915, near York. The data combined in the appended Table are taken from the detailed Report of these trials.

Motor tried	Make	Power	Price	Uses	Fuel burnt	Area ploughed in hours
Fowler motor plough.	J. FOWLER & Co., Leeds.	10 HP	£ 159	Will draw any cultivator. Can drive small stationary machines but not big threshers. Will not do rope haulage.	Petrol 2.5 gallons Can also use benzol and may be adapted for using paraffin.	2.49 acres
Universal Tractor. 20	SANDPIKON & MILLS, Bedford.	20 BHP	£ 327	Will draw any cultivation machine; 3 reapers or 2 reapers and binders. Will drive stationary machine's including large threshers. Will haul up to 5 tons on road.	Paraffin with 9% of petrol. 8.3 gallons	9 acres
Mogul Tractor 16 HP	INTERNATIONAL HAR- VESTER CO., Lon- don.	16 HP	£ 274	Will draw 2 reapers and binders. Will haul up to 5 tons on road.	Paraffin with 9% of petrol. 8.7 gallons *	6 acres
Mogul Tractor 25 HP	Dra.	.25 HP	£ 435	Will execute all work including road haulage.	Petrol 5 gallons	10 acres
Overtime Tractor.	THE OVERTIME FARM TRACTOR CO. Ltd., London.	24 HP	£ 233	Will execute all work except ordinary road haulage.	Paraffin 5 gallons	6.2 to 6 ac. according to the compact- ness of the soil.
Sandusky Tractor 40/45 HP.	MILLS & SONS, Lenton	38 BHP	£ 532	Will execute all heavy work, including road haulage.	Benzine **	**
Prainer Tractor	THE DAMMER Co. Ltd., London.	40 HP	£ 605	Will execute all work, including road haulage.	Petrol 6.2 gallons	8.5 acres
Mann Steam Tractor 22 BHP	MANN'S PATENT STEAM CART AND WAGON Co. Ltd., Leeds.	22 HP	£ 469	Do.	Coal 2.5 cwt	8.5 acres

* Estimated quantity. — * It was not possible to obtain these data during the experiments. The suckers indicate a consumption of 2 gallons of petrol per acre.

808 - Portable "Vasino" Cereal Drier. — TARCHETTI A., in *Il Giornale di Risticoltura*, VIII Year, No. 7, pp. 119-124, 2 fig. Vercelli, April 15, 1916.

This drier, mounted on wheels, and designed by MESSRS. VASINO BROTHERS, at Ponzana (province of Novara, Italy), is on the *tipping plane* system, (like the types CATTANEO GEMINARDI & GUIDETTI ALBERTINI) BOLTRI, etc.). The appended figure shows the arrangement of its essential parts.

The case shaped like a parallelopiped, is divided into superposed compartments by a series of horizontal aprons (9) made up of strips of metal gauze or perforated tin plate, each of which turns on its horizontal axis, tipping and thus emptying the grain to be dried on the apron immediately beneath. Each shaft has an end which is prolonged outside the case and is fitted with a fork lever through which an endless metal cable passes; this cable can run horizontally in a parallel direction to each of the successive aprons, while rising zigzag from one floor to the other, owing to 2 opposite sets of grooved pulleys which are fitted alternately at one end of each floor; it is fitted with an excentric cam which is unable to pass through the fork and therefore compels each lever in succession to shift and to tip the corresponding strip of the apron; then, as soon as the fork is released from the excentric, it is returned to its position by a spring or counterweight fitted to each lever.

Of course the tipping movement of the strips making up the apron, produced in this way by the cable movement, is intermittent. It is made to recur at lesser or greater intervals (generally from 10 to 20 minutes) according to the degree of dryness required in the grain. The stopping and starting of the cable are controlled by a special device placed in front of the machine at *O* and *E*.

The hot air used for drying is supplied by the stove *B* placed behind the car; it is drawn up from below by the aid of 2 large fans *C* fitted to the side walls of the stove, and is injected into the case through a set of nozzles *m - m' - m'' - m'''*, the flow being regulated by the dampers *s - s' - s'' - s'''*.

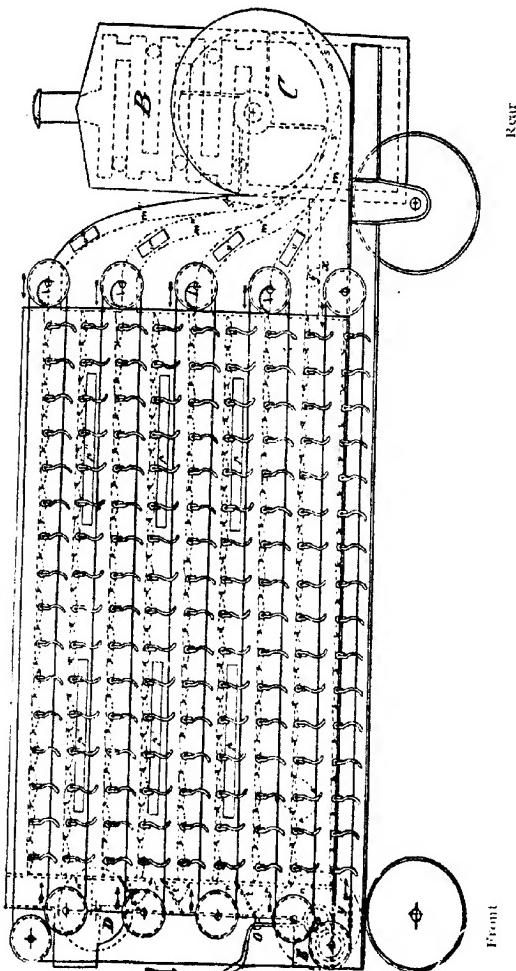
This injection of hot air does not take place into each compartment but only in one out of two, so that between each pair of compartments thus ventilated there is one which the hot air is compelled to enter after passing through the layers of grain on the upper and lower aprons, afterwards emerging from the case through the front apertures *n - n' - n'' - n'''* or the side aperture *p - p' - p'' - p'''*, provided in the walls.

Two suction arrangements *D* accelerate the air current at will. On the other hand the pipe *x*, fitted with a damper, brings the lower compartment into communication with the air inlet from the stove. By operating the damper *x* and the dampers *t - t' - t''* provided in the pipe of the suction devices, therefore, the hot air more or less saturated with moisture emerging from the case can be utilised wholly or in part.

The grain to be dried is inserted in the apparatus every 10 or 20 minutes, and spread in a uniform layer of 3 to $4\frac{3}{4}$ inches thickness on the upper apron, from which it descends, passing successively through the other to the lower apron, and on reaching the latter is deprived of its moisture.

From this lower apron the dry grain is discharged automatically onto the ground, after being gradually recooled by means of the cold air drawn in from without through the suction fan *D* or the tube *x*.

Vasino Grain Drier - Longitudinal Section



The advantages possessed by the Vasino drier may be summed up as follows:

- 1) Machine occupying very little floor space, the portable type with 9 aprons examined by the writer weighed 1102 lbs. and measured : length 18 ft., width $8\frac{1}{4}$ ft., height 10 ft.
- 2) Simplicity and reliability of the apron tipping mechanism.
 - 3) Great facility in altering the path and temperature of the air used for drying, according to the kind of grain to be dried.
 - 4) Possibility of carrying out very energetic drying by always passing dry air through.
 - 5) High efficiency.
 - 6) Limited fuel and power consumption (hardly more than 1 HP).
 - 7) Little labour required : 1 workman to feed the machine and 1 to look after the discharge.

The output of this drier of course depends upon the degree of dryness required. The makers assume that in order to dry paddy which is not over-wet it will suffice to pass it through the machine twice for 15 minutes at a time, and under these circumstances they estimate the continuous daily output (12 hours) at about 177.12 cwt. of dry paddy.

899 - **Machine for Gathering Cotton Fruits without Injury to the Plant.** — *Scientific American*, Vol. 114, No. 22, pp. 551 and 564, 3 fig. New York, May 27, 1916.

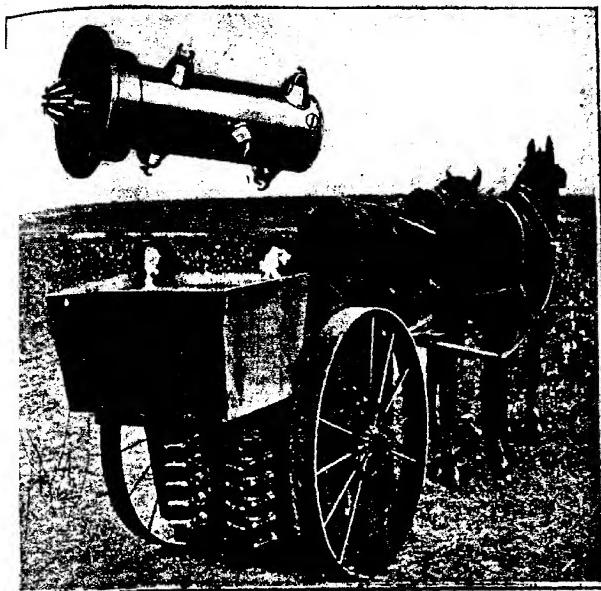
A light machine (900 lbs.) in the shape of a 2 wheeled cart with broad tires, the mechanism for gathering the ripe fruits of the cotton plant being located between the wheels.

It is drawn by 2 horses straight over the rows, so that the working parts detach the fruits of the plant and deliver them into a wooden box at the rear of the cart.

The cropping mechanism comprises 100 fixed arms (one of which is shown separately at the top of the annexed illustration), each carrying a number of revolving points, which gather the ripe bolls. These arms, directed backwards and thus working in an opposite direction to that of the cart, are fixed on gutter-shaped metallic supports (hollow laths), with which revolves a shaft which, by means of gearing, transmits to the point the rotatory movement which it receives itself by means of an endless chain driven from the wheels of the moving cart.

The arm supports, which can themselves revolve on their shaft and move backward when the cart is going forward (again by means of the endless chain), are arranged in 2 symmetrical groups separated in the middle by a space for the plants which are being cropped. In proportion as the machine advances above a row, the arms, by means of their revolving points, pick almost all the ripe bolls of a plant at once, without injuring the plant (because the arms remain stationary with the plant while the entire vehicle continues to move) and leaving the unripe fruits for a subsequent crop. On completion of this crop the plant is left behind the machine and the arms, owing to rotation of their supports, drop down on each side of the apparatus towards the wheels, still holding the detached bolls. The direction of rotation of the points is then automatically reversed ; they release the boll which fall to the bottom of the elevator and are fed by it into the box at the back, where the cycle of operations in relation to one plant terminates.

This cycle begins afresh for the following plant, first by bending down the stems towards the free space in the middle, enabling them to gather the bolls



Machine for gathering cotton fruits without injury to the plants.

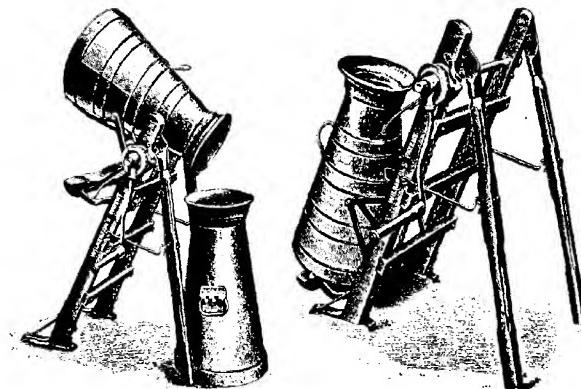
and continuing and finishing afterwards as described above, the same process being repeated for all the plants in one row.

Milk Can Emptying Machine. — *The Implement and Machinery Review*, Vol. 42, No. 495, p. 312, London, July 1, 1910.

By the aid of this contrivance, built by the firm of S. WILKERSON, Aspinwall (Cambridgeshire, England), and which is used to empty the milk from one can into another or from a can into a tank, a boy can do as much work as 2 labourers without any fatigue as he only requires to turn the tank; in addition the losses of milk which usually occur in emptying by hand are avoided.

The apparatus may be built for any height; it has folding legs to facil-

itate transport, and can also be easily converted into an ordinary *sad* hoist.



WILKERSON Milk can emptying machine.

901 - Review of Patents.

Tillage machines and implements.

- | | |
|--|--|
| Austria | 71 833. Cultivator. |
| British India | 2 089. Improved plough attachment. |
| Germany | 283 708. Harrow consisting of two parts connected by a joint. |
| | 283 863. Ditching machine. |
| | 284 228. Arrangement for ploughing with portable engine. |
| | 284 414. Motor plough with beam moving in a vertical plane. |
| | 284 414. Cultivator with twisted spring teeth and obliquely placed disk. |
| | 284 495. Device for preventing fouling of the bars bearing the shares of gang ploughs. |
| | 284 496. Soil divider for furrowing ploughs. |
| | 284 553. Ditching plough. |
| | 284 712. Hoe with adjustable blade. |
| | 284 713. Plough with couch grass lifter. |
| 284 963. Balance plough. | |
| 285 007. Machine for cutting irrigation ditches in meadows. | |
| 285 086. Motor plough with frame that can be raised or lowered. | |
| 285 166. Guiding apparatus for agricultural machines, especially for motor ploughs. | |
| 285 412. Shovel wheel for motor ploughs the shovels of which have a digging and throwing motion. | |
| 285 618. Motor plough with automatic starter. | |
| 285 720. Machine for bringing sub-soil to the surface. | |
| 285 749. Plough cable with electrical conductor core. | |
| 285 843. Brake for cable ploughs with electrical drive for return. | |
| 151 660. Improvements in common ploughs drawn by animals. | |

- Spain 61 892. Plough.
 Switzerland 72 705. Turn-wrest plough with adjustable draught device.
 United Kingdom 1 581. Means for propelling ploughs, cultivators etc.
 United States 1 181 106 — 1 181 394 — 1 183 828. Harrows.
 1 181 287. Wing harrow.
 1 181 345 — 1 183 138. Ploughs.
 1 181 353 — 1 182 340 — 1 183 482. Cultivators.
 1 181 480. Attachment for ploughs.
 1 182 154. Multiple section stalk cutter.
 1 182 304. Corn harrow.
 1 182 826. Combined hoe and seed planter.
 1 182 910. Coupling for a tractor and plough.
 1 183 465. Traction plough.
 1 183 686. Reversible side hill plough.
 1 183 723. Cotton cultivator and chopper.
 1 183 783. Lister plough.

Manure distributors.

- Austria 71 580. Manure distributor.
 Germany 284 029. Fertilizer distributor especially for cyanamide.
 284 364. Manure spreading device.
 284 449. Fertilizer distributor in which artificials are blown out from a series of nozzles close to the ground.
 285 087. Machine for communuting and spreading farmyard manure.
 United Kingdom 2 893. Manure distributor.

Drills and sowing machines.

- 283 680. Device for ploughs of potato planters.
 284 030. Device for adjusting the openings of seed holes in agitator seeders
 284 384. Drill feeder with adjustable bottom.
 284 385. Sowing machine with distributing wheels in the seed hopper.
 285 679. Potato planter.
 286 251. Elevator for potato planter.
 Switzerland 72 706. Sowing machine.
 United States 1 181 436. Corn planter attachment.
 1 181 539 — 1 181 930. Seed drill.
 1 183 346. Corn planter.

Reapers, mowers and other harvesting machines.

- Austria 71 840. Knife for mowers.
 Germany 285 062. Device for lifting the knife of mowers into a vertical position.
 285 167. Horse-rake in which the rake can be lifted by gearing on the wheels.
 285 238. Knife for mowers.
 285 292. Horse-rake.
 285 825. Swath rake convertible into a tender.
 United Kingdom 2 585. Hay-cooking machine.
 2 667. Apparatus for stacking hay, straw, etc
 3 081. Hay making machine.
 United States 1 182 110. Hay unloading apparatus.
 1 182 846. Grain shucker.

- 1 182 899. Mowing machine.
 1 183 065. Two row corn-cutter.
 1 183 092. Traction binder or header.
 1 183 768. Corn cutting machine.

Machines for lifting root crops.

- Denmark. 71 479. Potato lifting machine.
 21 166. Potato lifting machine.
 21 218. Device for potato lifting machine.
- Germany 283 866. Beet topping machine with one knife.
 283 867 — 284 242. Riddling and delivery of potatoes in potato harvesting machines.
 284 229. Potato fork with interconnected tines.
 284 651. Throw wheel with collapsible spring tines for potato harvesters.
 285 510. Tine wheel for discharge of stems and leaves from potato harvesters.
 285 511. Beet harvester with forks, which pull the roots almost vertically out of the soil.
 286 140. Forks for lifting potatoes and the like.
 286 141. Potato harvester with throw wheel revolving in the same direction as the machine proceeds and delivering the potatoes sideways.
 286 158. Potato harvester with a seat behind the shares for a person pick out the stems and leaves.
 286 230. Potato harvester with share, oscillating screen and riddle dry
- United States 1 181 768. Potato harvester.
 1 182 149. Beet pulling and topping machine.

Threshing and winnowing machines.

- Austria 71 834. Threshing machine in which the sheaves are fed sideways.
 France 479 762. Threshing machine for cereals and forage seeds.
 Germany 284 031. Wheat cleaner and grader with shaking endless grading band.
 284 033. Straw shaker, the inclination of which can be adjusted, for threshing machines.
 284 388. Winnowing machine with automatic regulation of the current air.
 284 389. Drum for winnowing machine.
 285 413. Device for cleaning cereals, especially wheat.
 Italy 151 400. Automatic sheaf feeder for threshing machines.
 Spain 61 995. Apparatus for continuous feeding of threshing machines from the ground.
 United States 1 181 360 — 1 181 373. Grain saving device for threshing machines.
 1 183 156. Separator or grader.

Machines and implements for the preparation and storage of grain, fodder, etc.

- Germany 284 008. Wire guide with clamp for straw presses and the like.
 284 386. Device for hoisting the bundles of straw turned out by straw binder.
 285 206. Machine for separating hairy weed seeds.
 286 159. Potato sorting machine.
 United States 1 181 497. Hay press.

- 1 182 144. Potato separator.
 1 182 436. Wagon hay stacker.
 1 182 718. Self feeding and self tying mechanism for hay presses.

Dairying machines and implements.

- 71 338. Separator for milk and the like.
 71 339. Combined milk sieve and cooler.
 283 840. Supply-can for milk separators.
 284 243. Holder for the tails of cows, while milking.
 284 365. Churn revolving round a vertical axis.
 284 366. Centrifugal friction-coupling for milk separators.
 284 367. Device for the automatic closing of the suction pipe from the teat cups in milking machines.
 284 640. Milk separator with plates.
 285 009. Valve for interrupting the suction in the teat-cups of a milking machine when the flow of milk ceases.
 285 010. Elastic sides for teat-cups with varying thickness along their length and with reinforced bottom provided with an opening.
 285 168. Butter machine with rotating churn and an obliquely mounted beater.

Other agricultural machines and implements.

- 2 253. Improvement in and relating to manufacture of paper making pulp from esparto and the like.
 283 748. Vermin trap with hoop for net.
 283 865. Tractor for ploughs with steering wheel in front of driving wheel.
 283 904. Apparatus for feeding sucking-pigs.
 284 095. Trap for rats, mice and other animals.
 284 130. Beet slicer.
 284 342. Cable drive for the road wheels of agricultural machines.
 284 450 → 285 063. Chaff cutter.
 284 493. Agricultural tractor with two driving wheels each driven by an electric motor and with a generator of electricity driven by an internal combustion machine or the like.
 284 497. Device for killing injurious animals.
 284 599. Device on agricultural machines for carrying the reins of the draught animals.
 284 711. Agricultural motor.
 284 951. Wild mustard weeder.
 284 984. Crank driven machine for felling trees and cutting timber by means of a wire heated by friction.
 285 008. Cable with electrical conductor core.
 285 166. Steering device for agricultural machines especially motor ploughs.
 285 263. Ventilating device for clamps.
 285 264. Chaff cutter with endless chain feeder.
 285 329. Agricultural motor that can be used as motor car.
 285 471. Three-wheeled agricultural motor.
 285 512. Apparatus for sharpening scythes by pressure and traction.
 285 513. Machine for making ribbon shaped fly-catchers.
 285 783. Device for watering trees.
 285 807. Watering can.

	285 821.	Sieve with alternate conical depressions on each side.
	285 890.	Horse feeding apparatus.
	286 003.	Automatic feeding apparatus especially for pigs.
	286 035.	Clockwork device to scare birds by shooting.
	286 070.	Device for controlling vermin, especially earth-fleas.
Spain	61 992.	Olive crusher.
United Kingdom	1 721.	Machine for extracting essential oil from limes and oranges
	1 844.	Appliance for protecting growing strawberries.
	2 117.	Sugar cane mills.
	2 955.	Collapsible cloche for horticultural purposes.
	2 971.	Apparatus for cutting and slicing vegetables.
United States	1 181 253.	Alfalfa mill.
	1 182 104 — 1 182 883 — 1 183 123.	Tractors.
	1 183 381.	Traction engine.
	1 183 660.	Caterpillar tractor.

FARM
BUILDINGS.

902 — **New Method of Fireproofing Wood** (1). — *Engineering Record*, Vol. 72, No. 24, p. 71; New York, December 11, 1915.

This method of fireproofing shingles was tested in the Forests Product Laboratory at Madison (Wisconsin, United States). It is based on the formation of an insoluble salt, borate of zinc, which melts at a high temperature and covers the fibres of the wood with a protective coating.

The air-dried shingles are first impregnated with a watery solution of borax, then stove-dried until their percentage of moisture does not exceed 10 per cent. After this they are impregnated with a solution of zinc chloride, once more dried in the stove, and are then ready for use.

The two solutions must be applied under high pressure, which necessitates the use of strong plate reservoirs, pressure pumps, standardised recipients and other comparatively expensive contrivances. Consequent on this process can hardly be used to advantage except where large quantities of wood are to be treated.

The experiments have shown that the shingles treated by this process and immersed in running water for two weeks had not lost their fire proof properties thanks to the insolubility of the zinc borate.

When exposed to a fierce fire the shingles treated burn, it is true, without flame, which is an important quality, because it prevents the fire spreading from one part of the roof to another by the falling sparks burning brands.

903 — **Fencing-poles with Rot-proof Feet.** PLUMFAY G. L., in *American Agriculturist*, Vol. 66, No. 22, p. 6. New York, November 27, 1915.

By the following comparatively inexpensive method, fencing poles may be provided with a rot-preventing cement foot.

Along each pole from 1 to 2 angle irons are fixed which project outward from the pole by an amount equal to the length of the foot to be fixed in the ground ; this free end is placed vertically in the middle of a varnished terra-cotta drain (or 2 superposed drains), after which the empty space

(1) See *B.* 1914, No. 462.

led with Portland cement mortar ; when setting is completed, the poles are ready to be fitted up.

Poles of this kind can last an indefinite time, especially if the precaution taken to paint them afresh every year. When the wood begins to rot, it can easily be detached from the foot and replaced.

— **Device for protecting Sucking-Pigs.** — DESSAISAIN R., in *Journal d'Agriculture pratique*, 50th Year, 1916, No. 12, pp. 216-217, 2 fig. Paris, June 15, 1916.

Various arrangements have been contrived to prevent sows from overing their young when lying down along the wall of the sty. Among these contrivances the following, applied in various piggeries in Switzerland, may be pointed out : along the walls of the sty, a series of irons *f* are placed, at about 20 inches distance from each other. Fig. 2 is a detail view of one of

Arrangement for protecting Sucking Pigs.

Fig. 1

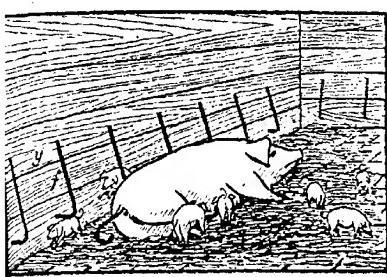
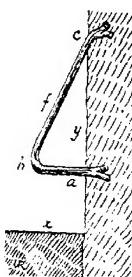


Fig. 2



the irons, *f* the lower limb *a* of which is at 6 or 7 inches above the ground in the sty ; this height can be altered according to the size of the sow, the point *b* being always about level with the teats. The rounded projection about 6 or 7 inches in front of the wall *v* and the upper point *c* may nearly 16 inches above the limit *a*. The round irons *f* 0.6 to 0.8 inches diameter, have their ends run into the brick wall ; if the wall is made of stone they may end in a claw so as to fix them by means of screw rings.

The arrangement under examination provides the young pigs with a passage either below or above the limb *a*.

RURAL ECONOMICS.

905 - **Discussion as to the Method of Effecting Valuations.** — ALBANI GIUSEPPE, in *Il Monitore Tecnico*, XXIInd Year, No. 7, pp. 97-100; No. 8, pp. 117-120. Milan, March 19 and 20, 1916.

An examination of the fundamental principles which prove the utility of the analytic method in valuation, and determine the limits of accuracy between which theories of valuation may be accepted in practice.

Valuation considers real estate as wealth in the strict sense of the word (static aspect) or as capital, that is to say, wealth tending to reproduce wealth (dynamic aspect).

Valuation can only estimate the value of real estate at a given economic moment, because the unit of measurement, currency, changes in value, *i. e.* in potentiality of exchange, in the course of time.

One of the practical fields for the application of the science of valuation is the market, where real estate wealth is exchanged for currency wealth which takes the name of price; but according to the writer, the field of action of the market has different limits from those of valuation, because a properties which cannot be alienated and for which a value but not a price might be fixed are outside the market limits. Moreover, on the market, when the exchange of real estate is actually carried out, the status of the contracting parties has a great influence upon the particular market value in this case, while valuation, which is impersonal, does not allow for these influences. In practice, a valuation is often required for the purpose of estimating the selling value, thus compelling the valuer to base his judgment on that likely to be given by the market.

Market and valuation only deal with real estate considered as capital and can therefore only be estimated by capitalisation either directly or indirectly of the revenues and material advantages which it produces.

At any given moment, in each locality, the value of all the real estate furnishing equal revenues will be equal (provided of course that all form of positive and negative revenue are calculated). In view of the difficulty of valuing immaterial revenues, it is customary in practice to divide the revenue of real estate into material and immaterial revenues; the corresponding rate of interest is also divided into 2 parts, one being ascribed to the material and the other to the immaterial revenues. Then, only the material revenue are capitalised in proportion to their share of the rate of interest which, owing to this fact, will be greater or less than the current rate, according as the positive or negative revenues predominate in the immaterial revenues; the resulting capital value is considered as the value of the whole real estate.

To determine the value of real estate it is necessary to estimate: 1) the amount in currency of its material revenues and that of the share of immaterial revenues which can be valued; 2) the rate of interest according to which this amount is to be capitalised. According to the methods that can be employed in determining these data, a decision as to the value of the analytic method of valuation, can be made.

The writer divides valuations, according to their purposes, in 3 principal categories, in Table I :

TABLE I. — *Categories of Valuation.*

Valuations having for their final object the determination of capital as a source of capital independent of revenue	Revenue	Valuations for purposes of taxation ; for usufruct or life interest.
	Temporary Revenue	Valuations for mortgage security ; for compensation for damage caused by hail, etc.; of damage resulting from military action; in respect of temporary occupation; of indemnity for bad management of properties rented.
	Perpetual Revenue	Valuations for expropriation ; of improvements or damage caused by neglect; of servitudes; for change of value due to the opening of new public roads or the establishment of new means of communication.
	capital	Valuations of indemnity for fire, earthquake, etc.; Treasury valuations for ascertaining value for succession or death duties, etc.
	independent of revenue	Valuations for guarantee of dowry, trust properties, etc.; Valuations for changes in value of lands due to regulations for their improvement.

According to the economic nature of the real properties to be valued (buildings, building and farm lands, quarries, mines, etc.), the categories of Table II are drawn up.

TABLE II. — *Categories of Valuations according to the economic nature of the property.*

Real property yielding revenue	directly	material	in cash	real property let at a fair price payable in cash;
		immature material	in produce	real property let at a fair price payable in kind; real property managed or worked by the owner buildings to be demolished for utilisation of the building material;
		mixed	with dynamic function	buildings and lands required for social or public purposes for road construction, religious purposes etc.; sterile fields, properties yielding no revenue and incapable of yielding any;
			with static function	real properties with improvable revenue;
	indirectly			houses serving for purposes of pleasure;

The writer examines the categories contained in Table II and points out that none of them can escape the necessity of analysis in order to determine the capitalisable income it is capable of yielding ; he arrives at the same conclusions on considering the valuations according to the object they have in view. The difficulties of economic analyses are of 3 kinds, according to the amount of revenues which the real property can produce, the price by which its value may be expressed in currency, and finally the time to which these revenues and their valuations relate.

From an examination of these difficulties and the method which valuation suggests for overcoming them, the writer concludes that the valuation can only, quite conscientiously, draw up approximate judgments, and the valuer can only indicate the maximum and minimum limits within which are contained not only the value asked of him, but also all the values which each of the persons called upon to give their opinion may attribute to the real property in question. If he has to decide in favour of a single value the valuer will within these limits look for the normal average value, the determination of which for one real property always gains by being the result rather of an analytic valuation than of a market valuation ; because while the market value is made up of 2 parts which each contribute the personal tendencies to the exclusion of all others, the expert according to the rules of valuation divests himself of his own personality in order to assume a personality summing up the tendencies of the others.

Examining next the other methods of valuation termed *indirect*, *direct*, *empirical*, *statistical* and *mixed methods*, the writer observes that they take their rise more or less remotely from economic analysis, and with regard to the analytic method he draws the following conclusions :

In view of the fact that the value of real property depends on the total revenues obtained from it and the rate of interest at which they are capitalised, and that this value cannot be determined otherwise than by means of these two factors, it is absolutely necessary, after reviewing all the cases which occur in valuation, to conclude that each of these must be analysed in order to ascertain either the amount of the revenue or the rate of the material and immaterial revenues which can be derived from each real property and consequently the rate to be applied for capitalisation. As in the determinations there may be differences of valuation, the estimate must allow for extreme valuations; its conclusions must therefore usually be expressed within maxima and minima, between which the entire series of valuation of different persons may fluctuate, and it must, in order to reach these conclusions use the methods which the science of valuation shows to be sanctioned and accepted as accurate in practice. If the valuation is required to give a single precise value, it must select the latter within the scale lying between the two extreme values, either taking into account the particular conditions and the purposes of this special problem, or by calling to its aid all the subsidiary criteria which experience and practice may suggest, in order to find the standard of valuation which the majority of persons would apply in this particular case and for this particular object. In these cases the valuation must never be considered as containing any

plete and unassailable judgment. Under these circumstances the valuation can test the accuracy of its judgments by comparing its own estimate with other similar valuations in like cases, but it must do this carefully, given the extreme difficulty of establishing a perfect comparison between different cases.

Valuation should not resort to other methods than the analytic except for rough estimates, and should always maintain some doubt as to the accuracy of the results if they are not corroborated by a thorough examination, the direct consequence of which is to lead to an analysis. If it be borne in mind that analysis is, and should always be, the means by which the results are obtained or checked in the course of time, it may be doubted whether there really exist any other methods of valuation than the analytic method.

b.—Cost of Production of the Principal Cereals in European Russia. — KOTELNIKOV V. in *Сельское Хозяйство и Торговля, № 459, 15. Маркетинговая Земельная Аграрная и Сельскохозяйственная статистика*, review published by the Ministry of Agriculture. Vol. CCI, Year LXXVI, pp. 451-459. Petrograd, March 1915.

The section of Rural Economy and Agricultural Statistics of the Ministry of Agriculture recently published the results of an enquiry into the cost of production of the principal cereals in European Russia, namely, winter rye, oats, spring wheat, winter wheat and barley, and the profit obtained by each of these crops. The investigation is based on the replies given by farmers who are correspondents of the Section, and some institutions and persons interested in agriculture, to a list of questions addressed to them. The number of replies was 5 169, of which 3 737 related to peasant farms and 1 442 to those of large landowners.

The material collected in this way contains data concerning winter rye and oats in 60 governments, barley in 52, spring wheat in 47 and winter wheat in 47 governments. The governments of the kingdom of Poland are excluded from the enquiry. The data are grouped according to the governments and principal agricultural regions. The publication dealt with by the writer will be followed by two others, one of which will contain monographs of analytical data regarding individual farms, and the other the special enquiries to be carried out by some zemstvos, with the financial assistance of the Section, in governments more or less typical for each of the different regions.

The data collected are digested similarly to the cereals under study : they are regrouped for the governments according to the area of the farms. The first group contains farms with an area up to 154 acres; the second, those with between 54 and 135 acres; the third those from 135 to 350; the fourth, those from 350 to 1,350 and the fifth, those of 1,350 acres and upwards. Three averages are made : one for farms up to 135 acres, another for those with more than 135 acres and the third for all farms in the government.

Without dwelling on the details of treatment of the statistical data collected, we pass on to the data relating to the great agricultural regions of Russia which data have been combined by the writer in a somewhat different way compared with the publication of the Section, inasmuch as in determin-

ing the percentage of each of the elements of the cost of production there has also been taken into account the cost of renting of the soil, in view of the great importance of this factor in production. The table modified in this way is reproduced here. It contains the total of all the expenses of cultivation for each cereal. This total comprises: 1) the expenses for a the labour connected with production, tillage of the soil, sowing, after management, crop, carting away from the field, threshing and cleaning the grain; 2) the cost of the grain required for sowing; 3) the cost of the manure, including the expenses of its carriage; 4) general expenses, and the cost of renting of the soil. In addition, the table also indicates the cost of production of one bushel of each cereal; this cost also comprises the rent of the ground. In order, however, to determine this cost price, the value of the straw was deducted from the total expenses of production, that is to say, the cost of production of the grain alone is given, which, according to the writer, corresponds better to the actual conditions of agricultural economic life. Finally, in the table there is shown the percentage of each class of expenses relatively to the total of such expenses.

On comparing the particulars of the table, it is seen that the principal cereals grown in Russia arranged according to the cost of production fall into the following order: 1) winter wheat, 4s. 10d. per cwt; 2) spring wheat, 4s. 7d. 3) winter rye, 4s. 6d.; 4) barley 3s. 5d. and 5) oats 3s. 6d. The writer attributes great value to the figures collected inasmuch as they allow of ascertaining the value of each of the elements of production and the relation between these elements for each cereal and for each of the regions and governments; consequently some comparisons are made.

Winter Rye. — The cost of production of winter rye is higher outside the zone of "tchernoziom" than in that zone, both in respect of expense per acre (£ 2.15.2 against £ 2.6.3) and in the cost of one cwt. of grain produced (4s. 9d. against 4s. 4d.). Thus between the different regions of these two zones very great fluctuations are seen. The importance of each of the elements of rye production presents itself as follows: the highest value is that of the labour expenses; on the average throughout all Europe and Russia they represent more than one third of all the expenses of production of cereals; in the "tchernoziom" zone the amount of labour expenses is greater than outside this zone. The two other classes of expenses — soil-rent and manure — in European Russia are about the same in amount, each presenting $\frac{1}{5}$ of the total expenses (20.6 and 20 %); but in the tchernozik zone, the soil rent is the greater while in the other zone it is the manure. The sum of these two expenses gives similar values both for the tchernozik zone and for the other, namely 39.3 % in the former case and 41.7 % in the latter. The total of these expenses is said to determine the cost of production of the rye. The next class of expenses is represented for the no-tchernoziom zone by sowing expenses, and for the tchernoziom zone by general expenses; this difference is explained by the higher cost of production of the cereals, and consequently of seeds, and by the closer sowing in the former zone; in the tchernoziom zone, by the slight amount of culti-

Cost of Production of the Principal Cereals in European Russia.

Agricultural districts	Expenses per acre	Cost of production of one cwt. of grain	Percentage of total expenses				
			for land rent	for labour	for seeds	for manure	for general expenses
	£ s. d.	£ s. d.			I. Winter Rye.		
Central agricultural	2.11. 8	0. 4.10	31.8	31.3	10.6	15.1	11.2
Middle Volga	2. 4. 4	0. 4. 5	25.5	38.7	10.9	14.0	10.9
Lower Volga	1.18. 5	0. 3. 3	14.9	58.2	9.4	6.0	11.5
South-West	2.15. 2	0. 4. 1	24.2	39.2	10.7	14.7	11.2
New-Russia	1.10. 6	0. 4. 1	32.0	41.8	10.7	3.1	12.1
Little Russia	2.16. 2	0. 4. 8	27.3	35.8	8.5	18.7	9.7
Tchernozem Zone	2. 6. 3	0. 4. 4	26.4	39.5	10.2	12.9	11.0
Industrial	2.14. 5	0. 5. 1	20.5	32.9	12.2	25.4	8.9
White Russia	2.16. 0	0. 6. 0	19.0	34.2	12.2	25.0	6.6
Lithuania	2. 3. 7	0. 3.10	17.7	39.1	14.6	19.5	9.1
Lakes	3. 0. 2	0. 5. 2	15.4	36.0	13.1	27.4	7.8
Baltic (1)	3. 5. 6	0. 4. 6	19.7	33.0	11.1	28.6	7.6
Outside the Tchernozem zone . .	2.15. 2	0. 4. 9	15.7	36.6	13.1	26.0	8.7
European Russia . . .	2.10.10	0. 4. 6	20.6	37.9	11.8	20.0	9.8
					II. Oats.		
Central agricultural	2. 3. 5	0. 3. 8	30.8	33.6	13.3	9.0	13.3
Middle Volga	1.16. 8	0. 3. 2	24.9	40.0	13.2	8.6	13.2
Lower Volga	1. 9. 1	0. 3. 2	15.8	56.7	12.3	1.5	13.7
South-West	2. 7. 2	0. 3. 4	26.7	15.0	12.6	1.9	13.8
New Russia	1.17. 3	0. 3. 4	31.8	41.9	11.7	1.8	12.8
Little Russia	2. 5. 3	0. 3. 6	28.7	36.8	10.8	11.6	12.1
Tchernozem Zone	1.19. 6	0. 3. 5	27.0	40.0	12.3	7.7	13.0
Industrial	2. 4. 8	0. 4. 0	14.1	39.2	18.7	16.1	11.6
White Russia	2. 6. 6	0. 4. 1	20.1	36.3	17.7	14.1	11.8
Lithuania	1.19. 2	0. 2.11	14.7	40.0	18.8	16.2	10.3
Lakes	2. 8. 0	0. 4. 3	16.7	38.7	10.6	15.2	9.7
Baltic (1)	2.10. 3	0. 2. 8	25.5	38.7	16.2	8.6	11.0
Outside the Tchernozem zone . .	2. 4. 0	0. 3. 8	16.5	39.4	18.5	14.7	10.9
European Russia . . .	2. 1.11	0. 3. 6	21.5	39.7	15.5	11.3	11.9

(1) For the Ural region and the Northern region, no data are available as to the cost of production of winter rye, winter wheat, oats or barley.

Cost of production of the principal cereals in European Russia

Agricultural districts	Expenses per acre	Cost of production of one cwt. of grain	Percentage of total expenses				
			for land rent	for labour	for seeds	for manure	for general expenses
	£ s. d.	£ s. d.	III. Spring wheat.				
Central agricultural	2.13. 0	0. 5. 1	33.2	33.7	14.6	6.8	11.9
Middle Volga	2. 1. 3	0. 4. 5	25.8	40.1	17.6	4.7	11.5
Lower Volga	1.15. 3	0. 3. 8	20.7	53.4	14.3	1.7	9.9
New Russia	2. 1. 4	0. 4. 7	32.2	39.4	14.8	1.7	11.9
Little Russia	2. 2. 9	0. 4. 11	29.7	35.1	14.2	10.2	10.3
Tchernozem zone	2. 4. 3	0. 4. 7	28.8	39.4	15.1	5.4	11.4
	£ s. d.	£ s. d.	IV. Winter wheat.				
Central agricultural	3. 1.11	0. 5. 1	33.5	30.4	12.5	14.8	8.9
South-West	3. 4. 4	0. 4. 10	24.9	36.4	11.5	17.3	9.9
New Russia	2. 5.	0. 4. 2	29.7	41.0	13.8	4.8	10.7
Little Russia	2.18.10	0. 4. 7	27.3	34.5	10.7	18.1	9.3
Tchernozem zone	2.17. 8	0. 4.11	28.7	35.2	12.0	11.4	9.1
White Russia	3. 1.11	0. 5. 3	20.9	34.5	12.7	23.8	8.9
Lithuania	2.12.11	0. 3. 9	17.5	40.8	10.5	17.5	7.7
Baltic	3.17. 3	0. 4. 10	18.8	32.0	12.2	30.0	7.8
Outside the Tchernozem zone . .	3. 2.10	0. 4. 9	18.7	35.2	13.6	24.5	7.9
European Russia	3. 0. 3	0. 4.10	23.5	35.3	12.9	19.6	8.7
	£ s. d.	£ s. d.	V. Barley.				
Central agricultural	2. 7. 2	0. 4. 1	33.0	36.9	10.2	5.7	14.1
Lower Volga	1.15.11	0. 3. 3	21.0	55.1	8.9	1.7	12.2
South-West	2.10. 0	0. 3. 4	26.8	36.2	12.1	12.0	13.0
New Russia	1.18. 7	0. 3. 2	27.4	45.1	19.9	2.3	13.4
Little Russia	2. 6. 0	0. 3.10	29.3	38.0	11.0	9.9	11.9
Tchernozem zone	2. 2. 2	0. 3. 2	28.0	41.0	11.2	7.1	12.7
White Russia	2. 9.11	0. 4. 1	21.9	37.4	14.2	15.6	10.9
Lithuania	2. 1. 1	0. 3. 4	16.5	41.4	15.8	16.4	9.9
Lakes	2.10. 8	0. 4. 0	20.0	37.1	15.4	18.2	9.2
Baltic (r)	2.74. 7	0. 3. 8	25.4	49.0	13.4	12.0	10.1
Outside the Tchernozem	2. 7. 1	0. 4. 0	17.9	39.6	16.0	10.5	10.0
European Russia	2. 4.10	0. 3. 5	22.7	40.2	13.7	13.7	11.1

(1) For the Ural region and the Northern region, no data are available as to the cost of production of winter rye, winter wheat, oats or barley.

of other crops than grain crops which might be charged with a part of general expenses.

Winter Wheat. — The cost of production of this grain crop is nearly same in the two zones (4 s. 11 d. per cwt in the tchernoziom zone as against 4 s. 9 d. outside this zone), in spite of the higher expenses per acre 9 d. more per acre in the latter zone. This uniformity is due to the lower value of the straw in the zone outside the tchernoziom, the latter being valued in this zone at £ 1. as against 11 s. 4 d. in the tchernoziom zone. Among the different expenses of production the chief importance appertains, as in the case of winter rye, to the expenses for labour (4 %); then, for the tchernoziom zone, the second place is occupied by rent of land (28.7 %), and outside this zone by costs of manure. For winter wheat likewise, the total expenses for rent of land and for manure are most equal in both zones : 43.1 % in the zone of tchernoziom and 43.2 % in the other zone, and this total is the predominating factor in the cost of cultivation. The importance of the other classes of expenses is almost same as in rye cultivation.

Oats — Among spring cereals, oats is the most widely grown. Its cost of production in the zone lying outside the tchernoziom region is slightly lower than in the latter zone 3 s. 8 d. as against 3 s. 5 d. per cwt); the biggest annual fluctuations of this cost are observed in the zone lying outside the tchernoziom zone.

Barley. — Its cost price is greater in the zone outside the tchernoziom than in the tchernoziom zone (4 s. per cwt as against 3 s. 2 d.).

Spring Wheat — Its cultivation is concentrated in 5 regions of the tchernoziom zone. The cost price for all these regions is 4 s. 7 d. per cwt of grain; fluctuations between the different regions are very great.

With respect to the importance of each class of expenses in the growing of spring cereals, it may be repeated that the most important one, i. e. the best relative amount, is represented by the costs for labour, and this importance is even greater than for the winter cereals. The second place with respect to all spring cereals in the tchernoziom zone falls to expenses for rent of the soil; outside the tchernoziom, in the case of oat cultivation, to expenses for rent of the soil, the latter being of almost equal amount both for cultivations : in respect of barley the expenditure for manure again similar in importance or amount. It is furthermore necessary to point out that in spring cereal growing the expenses for manure are relatively more considerable than for winter cereals.

Wheat-growing on the Share-farming System in the State of Victoria, Australia : Results obtained in 1915. — *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XIV, Part 3, pp. 179-180. Melbourne, March 10, 1916.

In 1905, the Department of Agriculture in Victoria asked farmers in the State to sow the largest possible area with wheat in anticipation of high prices. Unfortunately, a number of these farmers, having suffered heavily owing to failure of the previous harvest through drought, did not possess the necessary funds to increase their wheat sowings. This fact led several city investors to take an interest in the question, and they expressed

a wish to invest money in wheat-growing. The Department of Agriculture then undertook to put the farmers into communication with the capitalists, and a number of the latter concluded arrangements under which their financial aid was afforded for the purpose of more extensive wheat sowing.

One of them sent the Department of Agriculture a summary of the results of his investment. He supplied the necessary funds for cultivation on the share farming system 204 acres in Borung and 500 acres in the Mallee; that is to say, he paid the farmer a given sum for putting in and taking off the crop, supplied $\frac{2}{3}$ of the seed and manure, and in exchange took his account $\frac{2}{3}$ of the crop. The results obtained are set out in the appended Table.

I. — Borung.

Expenditure.

	£ s. d.
(1) Cash advance to farmer for working 204 acres of land at £ 1 per acre	204. 0. 0
(1) Seed wheat ($\frac{2}{3}$) at 7s. per bushel	50. 0. 0
(3) Two thirds of the cost of 5 tons of superphosphate . . .	15. 10. 3
(4) Sacks.	35. 15. 0
Total cost.	£ 305. 5. 3

Receipts.

Investor's share ($\frac{2}{3}$) of wheat: 2934 bushels

II. — Mallee.

Expenditure.

	£ s. d.
(1) Cash advance to farmer for working 500 acres of wheat at 16s.	400. 0. 0
(2) Seed wheat ($\frac{2}{3}$), purchase and carriage	74. 9. 0
(3) Manure ($\frac{2}{3}$),	25. 1. 0
(4) Sacks, purchase and carriage	44. 14. 6
(5) Carriage of wheat to railway station, 8 miles	41. 2. 0
Total cost	£ 586. 6. 6

Receipts.

Share of investor: 3744 bushels of wheat and 52 tons hay.

Thus the total sum invested by the capitalist in this undertaking £ 890.19.9, yielded him 6678 bushels of wheat at the railway siding, and 52 tons of hay.

Deducting from this sum the value of the hay at 30s. a ton the grain would have cost the investor £ 813 in all or 2s. 5 $\frac{1}{4}$ d. per bushel. Therefore he can realise a considerable profit on its sale, as the price of wheat f.o.b. in Victoria is at present 5s. 3 $\frac{1}{2}$ d.

The two farmers and the capitalist are so satisfied with their joint operations that they have entered into fresh contracts for still further extension of wheat-growing over 1000 acres this year.

- **Strawberry Farming as an Exclusive Cultivation in the South of the United States.** - *The Southern Fruit Grower*, Vol. XX, No. 5, pp. 101-102. Chattanooga, Tenn. May 1916.

In the Southern part of the United States of America the cost price strawberries relatively to the unit of area varies of course within fairly limits. In view, however, of the extension undergone by this cultivation in many Southern States, where there are numbers of farms engaged exclusively in strawberry growing, and where instances of farms cultivating more than 740 acres of strawberries and employing from 2000 to 0 work-people at harvest time are not wanting, it is interesting to publish the average data relating to the expenses and production per acre they result from a large number of statements issued from the United States Department of Agriculture.

The costs of cultivation, cropping and packing per acre vary within the owing limits, the lowest of which is considered to be the average of the later part of the producing centres, while the highest must be regarded in extreme limit only reached in some parts where the crops are exceptionally early, such as Florida.

Interest on capital invested	\$ 8 to \$ 15
Preparation of Land	5 to 10
Manure	10 to 25
Plant purchased	10 to 20
Setting plants	8 to 12
Cultivation, hoeing	20 to 35
Mulching	15 to 25
<hr/>	
Total cost per acre for first year.	70 to 142
Costs of picking, sorting and packing for an average crop of 2000 quarts per acre	30 to 72
Crates and Boxes	20 to 25
Costs of carriage to railway etc.	5 to 10
<hr/>	
Total expenses of cultivation and sale	111 to 247

Many strawberry growers secure a yield of 3 000 quarts per acre and yields of 4 000 and 5 000 quarts to the acre are not uncommon. A yield of 30 quarts is required to make the crop at all remunerative. The low prices ruling for strawberries at the time of greatest production have often led losses to the growers; some of them have found themselves under necessity of leaving from 20 to 25 % of the crop on the field. This drawback is about to disappear owing to the creation of industries which will convert the strawberries into jam, etc., in the centres of production. Manufacturers in some cases, treat the strawberries on the spot, with equal proportion by weight of sugar. They are put up in barrels and loaded in refrigerator cars, and sent to a cold-storage plant where they are kept until needed.

Some growers are at the present time studying the question of creating cooperative jam factories, with a view to utilising those strawberries

which are not adapted for putting on the market, being over-ripe, and at the question of the utilisation of the crop generally at times of over-production and fall of prices for fresh strawberries.

909 - **Cost of Milk Production in the County of Jefferson, State of New York, United States of America.** — HOPPER H. A. and ROBERTON F. E., in *Cornell University Agricultural Experiment Station of the College of Agriculture, Bulletin 357*, pp. 135-1 fig. 6a-65. Ithaca, N. Y., March 1915.

In order to ascertain the cost of milk production, the county of Jefferson, New-York, was selected. This is one of the New-York counties where agriculture is most progressive : it produces cereals, forage, etc., and it inferior to two only of all the other counties in the number of dairy cows bred there. The bulk of the milk production is converted into cheese although the trade in milk itself has made rapid strides of late years.

The organisation of a farm bureau in the county, which took place April 1912, allowed of obtaining the data set out in the Bulletin in question. The bureau founded three societies for testing milk production, including 653 herds distributed through the different parts of the county. Registration for one year of the production of 834 cows resulted in the following facts :

TABLE I. — *Average Production, Cost of Production and Profit for 834 cows.*

Item	Production per cow (lbs.)	Cost		
		per cow	per 100 lbs. milk	per lb. butterfat
Milk yield	6621			
Butter fat	241			
Cost of feed		\$ 51.57	\$.78	\$.21
Fixed costs		35.65	.51	.14
Interest on investment in cow plus hauling costs per cow	11.25	.17	.04	—
Total gross cost of production	898.47	\$ 1.40	\$.39	
Credit by calf and manure	18.23	.28	.07	
Net cost of production	880.24	\$ 1.21	\$.33	
Value of production	100.63	1.52	—	
Average profit	820.39	\$.31	—	

The cost of pasture per month per cow varied in the different societies from \$ 1 to \$ 1.5. The average spot value of mixed hay was \$ 1 per ton. Ensilaged maize (forage) was reckoned at the rate of \$ 4 per ton. The average cost of concentrates purchased was \$ 30 per ton. The net average annual cost of feeding one cow was \$ 51.57 or 64 % of the average cost of maintenance.

TABLE II. — Relation of Yield to Cost and Profit for 834 Cows.
Comparison of Groups of Different Productive Ability.

Group	Number of cows in group	Average cost of production	Net cost of production	Value of production	Profit per cow	Net cost per 100 lbs of milk	Profit per 100 lbs of milk
5,000 lbs or less	159	4.161	\$ 57.20	\$ 63.24	\$ 6.04	\$ 1.37	\$.15
5,001-7,000 lbs.	360	5.993	74.20	91.09	16.69	1.24	.28
7,001-9,000 lbs.	214	7.843	92.00	119.21	27.21	1.17	.35
9,001-11,000 lbs.	84	9.763	109.00	148.39	39.39	1.12	.40
over 11,000 lbs.	17	12.377	112.60	188.13	75.53	.91	.61
Total	834	—	—	—	—	—	—
Average	—	6.621	\$ 80.24	\$ 100.63	\$ 20.39	\$ 1.21	\$.31

The interest on the capital invested was reckoned at 5 %. The interest on the value of a cow was not assessed at more than 5 dollars nor the value of a calf at more than 10 dollars. The value of the manure produced in one year was reckoned at 15 dollars for a cow and 10 dollars for a bull. The cost of labour for milking and the care of the cow was fixed at 15 cents per hour of labour.

In Table I the most important figures relating to production, the expenses incurred thereby and the profit yielded are condensed. Table II indicates the relative profit furnished by individuals possessing different milk-producing powers.

In the study of the herds separately, it was observed that 7 out of 53 were kept at a loss of \$ 1335.71. On the basis of the net cost of maintenance and the sums recovered, it was found that 161 cows representing 19 % of the total number of heads, occasioned their owners a loss of \$ 1799.87, or \$ 11.18 per cow.

The average cost of labour for tending each cow was \$ 23.12. The average cost of conveying 100 lbs. of milk to a distance of 2.14 miles amounted to 11.7 cents. The profit yielded by each cow producing 10,000 lbs. of milk in the year exceeded by 51 % that given by each cow producing only 6,000 lbs.

Monograph on a Small Dairy Farm in Illinois. — BILL A. J., in *Hoard's Dairyman*, Vol. LI, No. 7, pp. 282 and 286. Fort Atkinson, Wis., March 10, 1916.

The University of Illinois Dairy Department has published the results of a monograph study of a small dairy farm in the county of Stephenson which forms a typical example of the well managed cultivated farm in this region which is devoted to agriculture. The data furnished by a study of the analytic accounts kept on the farm may be summed up as follows.

The farm in question has an area of 96 acres of an average value of \$140 per acre. On the farm 16 cows are constantly kept, and their milk is converted into butter which is sold exclusively to private customers in the town of Freeport.

Out of the heads under which the working of the farm was classified, twelve yielded a profit of \$206.86 and four left a net loss of \$25.40. Thus for the year there remains a net revenue of \$1981.46 or \$20.64 per acre, made up of \$868.16 interest at 5% on the total capital invested in the farm, and \$1113.30 profit in the strict sense. The farmer owner drew from his farm, in addition to the above revenue, \$700 as wages for his labour and that of one son, and \$186.30 for the board and lodging of a permanent farm hand. The total revenue of the farmer owner therefore amounts to \$2867.76 or \$30 p. acre cultivated. The total household expenses of the farm amounted to \$1802.24; there remains therefore a saving of \$1065.52, or \$11.10 per acre; it is expedient, however, to remark that the household expenses include \$42.155 used for education and charitable purposes; these cannot be considered as strictly living expenses.

The principal receipts of the farm are from the dairy cattle, which in all gave a gross return of \$2,868.95 divided as follows: \$1,854.62 of butter sold (66% of the dairy receipts), \$38.52 of butter and milk consumed by the household, \$44.70 of butter milk, \$165.11 of skim milk, \$220 of manure, and \$546 from the sale of cattle (17% of the total cattle receipts).

The dairy, however, defrays a large portion of the expenses of the farm, namely: \$575.45 for the remuneration of manual labour, \$106.16 for horse labour, \$113.13 for maintenance of equipment, \$120 for maintenance of buildings, \$105.34 for interest on investment, \$43.55 miscellaneous, \$128.57 fat bought, and \$1206.14 for feed; a total cost of \$2,398.34.

This leaves \$470.61.

The average value of the dairy cattle is \$74.37 per head; that of the 10 head of young cattle is \$39.75.

The total value of the food consumed, is divided as shown by Table I.

TABLE I. -- *Distribution of total value of food consumed.*

Ground maize	\$ 101.25	Silage	\$ 360
Forage gluten	\$ 86.25	Lucerne	\$ 60
Bran	\$ 105.19	Clover	\$ 140
Oil meal	\$ 34.45	Green forage maize . .	\$ 12
Barley	\$ 30	Straw	\$ 35
Oats	\$ 15	Pasturage	\$ 22.7

The portion consumed by the dairy cattle amounts to \$1016.65 in the following proportions: 34.7% grain, 47.6% roughage, 17.7% pasture.

The average return of each dairy cow is made up as follows: \$115.91 for butter, \$15.52 for butter milk, skim milk and products consumed by the household, \$13.75 for manure, \$29.75 from sale of cows and calves and increase of live weight, making a total return of \$174.93 per cow.

Table II brings out clearly the high amount of the individual production.

TABLE II. — *Individual Production of Cows.*

No. of cow	Age	Fat produced	Milk produced
36	4 years	1 lbs. 447	10 678
37	7	439	11 764
44	2	208	6 083
24	3	328	8 892
33	5	379	10 757
12	3	330	11 252
40	3	259	7 960
38	4	285	8 164
43	2	266	7 629
39	3	302	8 904
21	9	318	9 734
41	5	342	6 443
35	5	267	7 908
Total	4051	115 268	
Averages	312	8 867	

This production of milk furnishes in all 5 509.5 lbs of butter of an average price of 33.7 cents.

With regard to the expenses for each dairy cow, they are made up as follows: \$ 75.38 for food, \$ 42.61 for labour, \$ 31.91 general expenses; all \$ 149.90.

Thus a net profit of \$ 25.03 per dairy cow remains, including the wages and the butter manufacture in the valuation. Without these two factors, the net profit per cow drops to \$ 11.84 with a cost price of \$ 54 for food and an expenditure of \$ 29.05 for labour; in all, an annual lay of \$ 108.12 per dairy cow.

The calculation of the receipts, made for each cow alone, i. e. independently of the production of young animals and of butter manufacture, yields an individual profit of \$ 84.02 represented by the market value of fat in the milk (calculated as such and not in the form of butter), and a total individual value of \$ 119.96. In this method of calculation each pound of fatty substance in the milk costs 37.5 cents and fetches 41.5 cents giving a profit of 4 cents.

The 12 tables in which the expenditure and profits of each cow are followed up in their variations during the various months of the year present special interest. Another table separates the production of the 7 winter months from that of the 4 summer months. The winter period furnished 15 lbs. of fat and the summer period 2902 lbs., the feeding expenses fell to \$ 100.58 per month during the winter to \$ 62.52 per month during the summer period. The costs of labour (looking after the cattle, etc.) decreased, dropping from \$ 40.15 during the winter period to \$ 36.74 during the summer period.

The young cattle (10 head) have an average gross yield per head of

\$ 36.28 against an average expenditure per head of \$ 28.11., with a profit of \$ 8.17 per head, which proves that from raising a good breed of dairy cattle a profit per head may be obtained which is only $\frac{1}{3}$ below that yielded by the dairy cattle themselves. From an examination of the sale of butter in reference to its cost price it is found that the cost of making and selling is 32.1 cents per lbs. The butter sells at 33.6 cents per lb. and if allowance is made for the butter milk, the income is raised to 34.4 cents, leaving a gain of 2.3 cents per lb.

The number of hours of labour was, during the course of the year 6,950 and the cost was \$ 1275, which is equivalent to 2.2 labourer units.

The hired labour furnished by a permanent workman cost \$ 388.80 for wages and \$ 186.30 for board and lodging. The work of the farmes son was estimated at \$ 160, and that of the working farmer at \$ 600; the latter did 47 % of the total work; 45 % of the total work was absorbed in the dairy cows.

The distribution of the work during the year comprises: 457 hours per month for January, February and March; 611 hours per month for April, May and September; 741 hours per month for June, July and August; and 507 hours per month for October, November and December, with an average of 579 hours of labour per month.

The work of the horses is divided as follows: 210 hours per month for January, February and March, 577 hours for the 5 following months, and 387 hours for the last 4 months.

The manual labour is subdivided as follows: 46.8 % for the dairy cows and dairy and 53.2 % for all the other labour; the horses' work: 16.6 % for the dairy cows and 83.4 % for all the other work.

The results as regards cultivation are as follows: 15 acres of maize with a yield of 51 bushels per acre, a value of \$ 28.89 per acre and a profit of \$ 3.35 per acre; 8 acres of maize for ensilage, with a yield of 11 tons per acre worth \$ 450.12 per acre, costing \$ 441.63 and giving a profit of \$ 8.49 per acre; 20 acres of oats with a yield of 45 bushels per acre worth \$ 19.79 against a cost of \$ 14.02 and a profit of \$ 5.75 per acre; 3 acres of barley, which showed a slight loss, and 3 acres of lucerne, also worked slightly at a loss, as there was only the catch crop with oats; 18 acres of clover yielded 1.6 tons per acre worth \$ 16.86 against a cost of \$ 13.53, and a profit of \$ 3.33 per acre.

AGRICULTURAL INDUSTRIES.

DUCTRIES
PENDING
PLANT
RODUCTS

911 - A Palm Fruit Used for Flavouring Brandy.—GRIEREL C. and BAMES E.
Zeitschrift für Untersuchung der Nahrungs- und Genussmittel, Vol. 31, No. 9, 1916,
290. Münster i. W., May 1st, 1916.

In order to give the different varieties of brandy a special taste, flavouring materials are often used, which are mostly extracts from certain varieties of prunes, green walnuts, almond shells, etc. The writers describe a drug of this kind which is marketed under the name of " Bayas negra "

and has not yet been thoroughly studied, probably because morphologically it resembles a small prune. An attentive study showed that this drug is the fruit of the palm *Serenoa serrulata* Hook f., which grows in South Carolina and Florida.

According to the publications in connection with this subject the fruits of *Serenoa serrulata* are used to prepare an extract, the "Saw palmetto", used chiefly in North America as a remedy for pulmonary diseases, but they do not furnish other particulars with regard to this drug. The writers therefore proposed to study it after obtaining fruits of *Serenoa* from North America and some "Saw palmetto". They describe in detail the results of their researches.

The fruit is oval, contains a single seed and weighs from 1.5 to 3 gr. per carp, which is clearly divided into epicarp, mesocarp and endocarp, contains the greater part of the aromatic substances. The physical composition of the fruit is as follows:

Pericarp	Epicarp	36 %
	Mesocarp	16
	Endocarp	11
Seed		38

The chemical composition of the pericarp is as follows:

Water	15.41 %
Dry matter	84.59
Mineral matter	5.73
Chlorides such as Na Cl	1.52
Fat (ether extract)	26.73
Invert-sugar	28.26
Extract free from sugar and soluble in water	16.31
Insoluble matter	13.50

More than one fourth of the weight of the pericarp is therefore made up of fatty matter.

The strong rancid odour of the pericarp at once suggested that its fat contains a large quantity of free acids. It was in point of fact found that the smell and taste are chiefly due to free acids, probably caproic acid and other acids of low molecular weight. The crude fat extracted by ether is an oil of dark orange colour, yielding on analysis the following results:

Refractive index at 10 degrees	31.2
Iodine index	14.1
Acid index	201.4
Saponification index	226.
Reichert-Meissl index	9.5

The crude fat contains: 75 % of fatty acids and 25 % of neutral fat.

This analysis suggests the presence of an enzyme decomposing the fatty substances in the pericarp of *Serenoa*. Studies carried out with a

view to ascertaining this did not give conclusive results, but it is beyond doubt that a lipase does exist. It would seem that this lipase disappears during or after the ripening of the fruit.

The high content of fatty acids in the crude fatty matter is by no means abnormal for a fat originating from a palm fruit. It is precisely to these acids that the fruit owes its characteristic odour and its use in the manufacture of flavouring substances. An important part, however, is also played by an etherifying enzyme, as is particularly shown by the experiments with the American "Saw palmetto". On extracting the fruit with dilute alcohol, a liquid is obtained containing ethers the smell of which strongly suggests essential oil of grape (essence of brandy). Probably there is not one only but two enzymes acting in contrary directions, one of which decomposes the glyceric ethers of the fatty acids into acid and alcohol while the other once again etherifies the free fatty acids by means of monovalent alcohols. The action of the enzyme does not appear if the fruits of *Serenoa* are first treated with bichloride of mercury or other toxic substances.

From these observations it is concluded that the addition of an extract from *Serenoa* fruits to brandy may produce the impression of the presence of a percentage of substances imparting the natural flavour much higher than the actual percentage. This extract therefore must not be put into the same class with the other extracts (prunes, green walnuts, etc.) ordinarily used for flavouring brandy, as it does not merely flavour the latter, but "doctors" it, so to speak, and its use was rightly prohibited 2 years ago in Germany in brandy manufacture.

912 - Experiments in connection with Spinning Cotton after Fumigation with Hydrocyanic Acid. - DEAN WILLIAMS S., in *United States Department of Agriculture, Bulletin No. 366*, 12 pp. Washington, D. C., April 23, 1916.

To prevent introduction of the pink boll-woorm (*Gelechia gossypiella*) (1) in imports of foreign cotton, the Federal Horticultural Board of the United States of America found fumigation with hydrocyanic acid effective. It destroys the larvae even in the centre of a compressed bale of cotton. With a view to ascertaining whether these fumigations injure the fibres of the cotton the Department of Agriculture had practical spinning tests carried out at the New Bedford Textile School with two kinds of cotton, one part of which had been subjected to fumigation and the other had not. The results showed that the fumigations of cotton with hydrocyanic acid have practically no ascertainable effect upon the proportion of waste, the quality of the yarn, tensile strength, or the bleaching, dyeing and mercerising qualities of the cotton.

(1) See *B.* March 1913, No. 213, *B.* Sept. 1913, No. 1119 and *B.* June 1916, No. 711
(Ed.).

INDUSTRIES
DEPENDING ON
ANIMAL
PRODUCTS

913 - **Factors Affecting the Fat Content of Whole and Skim Milk.** — GUTHRIE E. C. and SPRULES G. C., in *Cornell University, Agricultural Experiment Station of the College of Agriculture, Department of Dairy Industry, Bulletin 360*, pp. 271-289, fig. 117-125. Ithaca, N. Y., April 1915.

Several factors influence the fat content of cream obtained with a separator (independently of the variations of such content due to displacements of the regulating device), viz.: the temperature, speed, rapidity of feed, content of fat in the full cream milk, the variations in the quantity of liquid (skim milk or water) which is passed through the drum of the separator at the close of the operation in order to force out the residue completely, &c., as is the case in practice, in the quantity of whole cream milk used for his purpose, and the quantity of milky deposit formed.

In order to determine the nature of these influences, the writers undertook the experiments described in the Bulletin in question, making use of different types of separator. The results proved the following:

The influence of low temperatures (the operations were conducted at temperatures varying from 21.¹⁰ to 32.²⁰ C) on the percentage of fat in the milk and the skim milk varies with the different types of separator. The results, which are particularly conclusive for two types of separator, seem to demonstrate that, all other things being equal, when the temperature is lowered the quantity of cream extracted is diminished, but that the weight of the fat contained in this cream remains constant.

With some types of separator the percentage of fat in the cream varies markedly even for a variation of 10 revolutions per minute in the revolution counter (corresponding to 1,500 revolutions per minute in the drum); on the contrary, other types exhibit this influence in a much less degree. In regard to the types of separator which showed variations in the percentage of fat, the writers find that when the speed diminishes the weight of the cream obtained increases, which was obvious *a priori*, but that the weight of fatty matter contained in the cream still remains constant. A variation of 10 revolutions per minute in the counter had no appreciable influence on the percentage of fat in the skim milk. The percentage of fat in the cream is practically directly proportional to the percentage of fat in the full cream milk. It increases slightly when the milk enters the drum slowly. The variation in the quantity of full cream milk utilised, or in the quantity of liquid employed to force the remaining cream out of the drum at the end of the skinning, has but little influence on the percentage of fat in the cream.

The milk deposited has only an insignificant influence on the percentage of fat in the cream and the skim milk, provided its quantity is not sufficient to choke up the passage through the drum.

914 - **Metallic Taste in Dairy Industry Products.** — GUTHRIE E. S. in *Cornell University Agricultural Experiment Station of the New York State College of Agriculture, Department of Dairy Industry, Bulletin 373*, pp. 603-644, 10 tables. Ithaca, New York, April 1919.

The metallic taste, which influences the price of dairy industry products, was first detected in 1901. The writer entered into correspondence with a large number of experts in order to determine exactly what is to be

understood by "metallic taste". According to these experts, such taste is closely akin to the fishy taste of oil, tallow, etc.; it is difficult to detect, but, nevertheless, qualified men succeed in detecting it when they have become familiar with it.

The writer studied the conditions under which the metallic taste appears in dairy products. He found that the direct absorption of metals may produce this flavour. His observations have furthermore demonstrated that a high content of acid seems essential for the development of the taste, which is more likely to appear during the very hot season. Furthermore, with the exception of butter milk, the taste only appears when the fat content is high. The taste appears suddenly, and low temperatures very often make it more noticeable.

Besides the direct absorption of metals, bacteria may produce the metallic taste. A quantity of butter milk put into sterilised bottles was found to have this flavour in some cases. In 241 samples of cream placed in sterilised glass bottles the metallic taste was produced in 79 by the inoculation of butter milk having that flavour; likewise in 167 samples of cream put into sterilised glass bottles the taste was produced in 52 by inoculation with bacteria.

The writer has studied the microflora of products having a metallic taste; he found on the other hand that the addition of formaldehyde only rarely prevents the occurrence of the taste, which appeared 35 times in 41 samples of butter milk of which there had been added, per 100 cc., from 2 to 30 drops of a solution containing 37 to 40 % of formaldehyde.

Finally the writer endeavoured to ascertain the relation between the production of enzymes and the appearance of the flavour by utilising products which prevent the growth of bacteria but allow of enzyme action. For this purpose toluene and chloroform were used: the results were not satisfactory, owing to the difficulty of distinguishing and analysing the taste of the liquids treated with these antiseptics. Nevertheless, it seems that the metallic taste can be produced by the action of enzymes.

In the inoculation experiments it was found that the bacteria capable of producing the metallic taste appear to be the same as the well known bacteria found in milk, and belonging to the group *Bacterium lactis acidii*, the only difference, if any, was that the former were a little larger than the types representing the group, but only very slightly. It is therefore concluded that the organism which causes the metallic taste is a member of or derived from the group *Bacterium lactis acidii*.

In an appendix, a bibliographical note gives a list of 8 works.

915 - **The Production of Beef in South Africa.** — HOLM ALEX, in *The Agricultural Journal and Small-Holders of South Africa*, Vol. III, No. 16, pp. 104-109. Johannesburg, April 1916.

The production of beef in the South African Union has made rapid strides of late years, particularly during the last two years.

In 1911 the Union possessed 3 500 000 cattle. In 1914 there were 5 797 000. The writer estimates their number at about 8 000 000 in the first half-year of 1916. In 1903 the value of imports of beef and mutton

mounted to £2 885 000. This figure continually declined until 1915 when it had fallen to absolutely insignificant proportions (£593).

On the other hand, in 1914 there were exported 532 358 lbs. of meat of value of £12 352. In 1915 the exports were 32 897 quarters of beef, i.e. in the first 11 months of the same year the meat exports totalled 11 752 lbs. of a value of £113 296.

In 1915 South African beef fetched on the London market from 5½d. to 7½d. per lb. or from 2d. to 3d. per lb. more than it would probably have fetched before the war. The cost of exportation, allowing for the value of by-products, is probably about 1½d. per lb.

In order to ensure still further the progress of this industry, it is advisable to use good bulls of a beef breed, so as to obtain earlier maturity, heavier carcasses and better adaptation for fattening.

At present South African cattle are chiefly draught animals. They attain maturity at the age of 6 years, and their quarters weigh from 1 to 160 lbs., while those of Argentine cattle for instance, average 180 to 200 lbs.

- Experiments in Potato Storage with Sulphur. — GERLACH, in *Illustrierte landwirtschaftliche Zeitung*, 36th Year, No. 37, pp. 268. Berlin, May 6, 1916.

Reference is made to an experiment in potato ensilage carried out on Mocheln model farm in order to test sulphur as a preservative. On the 1st October, 2 stacks of potatoes of the "Ella" variety were put into earth about 16 ins deep. Each stack contained 2 200 lbs. of hand-sorted potatoes. The potatoes were laid on a thin layer of straw, then successively covered with a layer of straw, earth, and potato leaves and stalks, and, when winter approached, with a second layer of earth. Silo No. 1 received addition of sulphur; in silo No. 2 there was first placed a thin stratum of powdered sulphur, then a 9 to 12 inch layer of potatoes, and so on. On the 22nd April following the silos were opened, and the potatoes tested and weighed. The following were the results found: silo No. 1 contained 2048 lbs. of healthy and 19 lbs. of rotted potatoes; silo No. 2 had 9 lbs. of healthy and 35 lbs. of rotted potatoes. Thus the rotting of the potatoes was not prevented by sulphur, but the latter impeded the reduction of weight in the potatoes.

Investigations into the Part Played by the Amylase in Potato. — See this *Bulletin* No. 551.

Experiments in Preserving Broken Eggs. — EICHELBAUM, GEORG, in *Biokemische Zeitschrift*, Vol. 74, No. 3 and 4, pp. 176-184. Berlin, April 29, 1916.

At the suggestion of the Central German Egg Purchasing Company writer carried out preservation tests by different means. The object was to find a substance which can be added to the thoroughly stirred mass of broken eggs, thus enabling the latter to be transported in cans to long distances.

The preliminary tests showed that substances with strong odour cannot be used, as it is afterwards impossible to free the eggs from the odour communicated to them. The writer indeed showed that even highly vola-

tile liquids, such as toluol and chloroform, impart their smell to eggs and cannot be entirely got rid of. Eggs preserved by the aid of these substances are no longer fit for consumption.

A study was made of the action of the following substances: toluol, chloroform, hydrochloric acid, acetic acid, mustard oil, benzoate of soda, boric acid, and salicylic acid. As time did not allow of keeping the eggs for a very long period, the conditions of lengthy transport were imitated by carrying out the experiments at a temperature of 37 to 38° C., at which the eggs were kept for 10 to 14 days. The eggs used were not entirely fresh being market eggs.

The results of the experiments may be summarised as follows:

Toluol	The smell and taste imparted to the eggs cannot be removed.
Chloroform	Do.
Hydrochloric acid	When used in the proportion of 0.5 % the eggs are liable to mould.
Acetic acid	When used in the proportion of 0.65 % rotting is prevented but the eggs acquire a sour taste and coagulate.
Benzoate of soda	When used to the amount of 1.75 % the eggs decompose and within 8 or 9 days.
Salicylic acid	Used in the proportion of 1-2 %. no rotting but deleterious change in colour and smell.
Mustard Oil	Strong smell of mercaptan; eggs no longer fit for consumption.
Boric acid	Used in a quantity of 1-2 %, no rotting after keeping for 12 days.

CONCLUSIONS. — For the preservation of broken eggs, only acetic acid, salicylic acid and boric acid give a sufficiently good result, but they must be used in fairly strong doses. The eggs nevertheless retain some flavor due to the preserving agent, and undergo chemical changes. The preserving agent is undoubtedly boracic acid, the use of which in Germany however meets with great difficulties on the part of the authorities; it is thought that the preservation of broken eggs should only be resorted to in exceptional cases, when any other means of keeping them is impossible. It is nevertheless recommended that these experiments should be repeated.

919 - Sale of Cattle through the Agency of Co-operative Shipping Associations in

United States. — DORR S. W. and HALL L. D., in *United States Department of Agriculture's Farmers' Bulletin*, No. 718, pp. 1-16. Washington, April 10, 1916.

In those parts of the United States where cattle breeding is not one of the most productive branches of farming, and especially wherever the dairy industry predominates, the majority of farmers have only a small number of animals available for sale at a given moment. This number is generally insufficient to load complete trucks, but exceeds the needs of the local markets and must be disposed of at more distant markets.

This state of things, which cattle dealers were not slow to turn to account, has led to the creation among farmers of co-operative cattle-forwarding societies. Examples were not wanting, even in the past, of farms coming to an agreement to effect this class of forwarding, but it is not until the last 7 years that these associations arose and developed (first started in 1908 at Litchfield, Minnesota).

At present the United States Department of Agriculture records the existence of about 500 societies of this kind. There are 200 in Minnesota alone, and the others are found, in decreasing order of number, in the following States : Wisconsin, Nebraska, Iowa, North Dakota, South Dakota, Kansas, Michigan, Illinois, Indiana and Ohio.

The annual increase in the number of trucks forwarded by the different societies proved clearly that farmers have rapidly appreciated the advantages of these institutions. It is estimated that in Minnesota alone £100,000 worth of cattle were sold in 1914 through co-operative forwarding and selling societies.

The expenses of sale for 1913 and 1914 averaged 33 cents per cwt. in the Litchfield society. Farmers are of opinion that this cost is from 10 to 40 cents per cwt. below the allowance which dealers made the basis of their offers to farmers. Assuming that the allowance imposed by buyers was only 50 cents per cwt. the Litchfield association will have saved the forwarders about \$6221 in 1914.

The simplicity of organisation, and the fact that no capital is required, render the collective sale of cattle very interesting in rural districts, where more complex forms of co-operative societies are more difficult to establish.

The principal conditions required for the success of these societies are : an able manager and full confidence on the part of members. The manager must be well known in the region and must be regarded as a man thoroughly at home in the cattle trade, and one in whom farmers can place entire confidence.

Practice has shown that in order to avoid possible mistakes it is indispensable to number and brand each animal at the forwarding station, even in the case of pigs or sheep, and to make a note of all such particulars may be required to be taken into account by the manager with a view to a fair distribution of the expenses and profits, or possible losses.

Farmers were quick to realise that the profits previously made by the cattle dealers thus went into their pockets, because through the agency of the society they really sell at the genuine market price less the actual selling expenses. Moreover, the work of an able society manager exerts an influence throughout the region in the direction of improving the methods of cattle breeding, and rendering farmers more familiar with the real market values. These indirect benefits are no less important than those obtained directly by the members of different societies.

On Control of the Sale of Skim Milk. -- BORDAS F., in *Annales des Falsifications*, Nos. 99-101, pp. 146-156. Paris, April-May, 1914.

After having rapidly considered the various operations of industrial commercial separating and the chemical and biological characteristics of skim milk, the writer opposes the current opinion that skim milk is simply milk deprived of its fat. He lays stress on the fact that it is an incomplete product which has also lost its glycerophosphoric acid, and been enriched on the other hand with numerous micro-organisms. After a study of the nutritive value of skim milk and a reference to the works published on the question, chiefly in Denmark, the attempt is made to show that the require-

ments of infants cannot be satisfied by giving them milk deprived of its fatty matter. It is shown that it is not a matter of indifference from the physiological point of view what is the age of the milk given to a new-born child. The milk given to an infant should be suitable for the age of the child. On the other hand, from the economic point of view, the writer proves that it is not in the producer's interest to sell milk skimmed to the extent of 85 % and still less entirely skimmed milk. This trade apparently can only be remunerative if the skim milk is sold at the same price as the whole milk. The writer therefore thinks it desirable to record the conclusions adopted by the Society of Technical Chemists of France at its sitting of the 10th May 1916, with which he is in complete agreement.

In view of the fact that the prevention of frauds due to the mixing of skim milk with natural milk presents the utmost difficulty :

The Society of Technical Chemists of France is of opinion that far from endeavouring to facilitate the sale of skim milk, or at any rate legalising its sale by municipal or prefectorial orders, it would be preferable in the interests of public health and commercial morality not to modify the present situation in any way, experience having shown that the municipalities which have recourse to regulation of the sale of skim milk by municipal order, for the purpose of putting a stop to frauds by skimming, have only obtained the practical result of bringing about the almost complete disappearance of full cream milk ;

Nevertheless, if it should be considered necessary for reasons of which the Society has no cognisance whatever, to resort to control, such control should be sufficiently severe and stringent to prevent a mother, in any case, and in any town of France, who might be unaware of the danger run by her child, being liable to have skim milk supplied to her in the place of natural milk.

LEGISLATIVE
AND ADMINI-
STRATIVE MEA-
SURES FOR THE
PROTECTION OF
PLANTS.

PLANT DISEASES

GENERAL INFORMATION.

1 - Decree of the Lieutenant-general of the King of Italy dated the 28th June 1916, No. 795, containing Measures for the Control of Field-voles in Apulia and adjacent Regions. — *Gazzetta ufficiale del Regno d'Italia*, Year 1916, No. 158, pp. 3463-3464. Rome, July 6, 1916.

Art. 1. Antiphylloxera Associations (1) are bound to engage in field-vole control. For that purpose they are authorised to enter on their contribution lists all the owners of cultivated lands.

Art. 2. For communes which do not belong to an Antiphylloxera Association the Prefect will take the necessary measures, forming a compulsory Association for field-vole control, in pursuance of art. 38 of the regulations approved by decree of the Lieutenant-General dated March 12, 1916, No. 723 (2).

Art. 3. The State will contribute up to one half of the expenses entailed by the present decree; it will advance the whole of the amount, and, for this purpose the sums appropriated in chapter 50 of the estimates of the Ministry of Agriculture for the financial year 1916-1917 will be increased by 600 000 lire.

The associations will be bound to refund one half of the amount of the expenses.

Art. 4. A Commissioner appointed by the Minister of Agriculture shall reside over the assessment of the expenses to be defrayed and their division between the State and the Associations.

Art. 5. In the estimates of receipts every year the share of expenses to be repaid by the Associations shall be entered, in accordance with art. 27 of the regulations approved by the decree of the Lieutenant General dated the 12th March 1916, No. 723, together with the interest provided in that article.

(1) See *B.* August 1913, No. 995, and *B.* January 1914, No. 71.

(2) These are the regulations for carrying into effect the law of the 26th June 1913, No. 888, which contains measures for the purpose of preventing and controlling plant diseases. See *B.* August 1913, No. 995.

The debt of the Associations will be secured in the manner provided in articles 28 and 29 of the regulations aforesaid.

Art. 6. No alteration can be made in the present administrative organisation of the Antiphylloxera Associations

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

922 — Measures to prevent Injury by Frost in Catalonia, Spain. — VIA RAVENTOS JOSÉ, in *Resumen de Agricultura*, XXVIIIth Year, Part 2, pp. 68-80, Fig. 2. Barcelona, 191

Observations on frosts and the best methods of preventing injury thereto in the vine-growing zone of the Lower Ebro. Under normal working conditions it is not always possible to make use of the instruments which allow of forecasting the arrival of cold waves a sufficient time beforehand in meteorological Observatories. There is, it is true, a relation between the temperature at the moment of sunset and the minimum temperature which can be reached during the night, but this relation changes with the variations of the mistiness and hygroscopic conditions of the air, and the value of these factors varies, even in a short time, within very wide limits. On the other hand, observation and long practice enable vine-growers to foresee the arrival of frost with some approximation to the truth, but certainly not with all the desired accuracy where it is a question of combating low temperatures by smoke, a costly and troublesome method which of course should only be applied when really indispensable. Good results have been obtained with automatic alarms. Their cost is not excessive and they are easy to use. They consist of a RICHARD thermometer set up in the middle of the vineyard at a height of 20 to 25 cm and communicating with a bell, actuated by the current of three LABLANCHE cells, which rings when the temperature sinks to the danger limit: one fourth of a degree centigrade above zero. That is the time when the fires must be lit. An excellent kind of fuel for the purpose is creosote briquettes. They are placed in LESTOUT furnaces, or even in simple wooden boxes, slightly sunk into the ground and arranged round the vineyard at a distance of 26 feet apart. On burning them under these conditions for a period of 5 hours, the cost (including material, labour, etc.) is about 16s. per acre, which is far from being an excessive amount, as the injury which the frost would have produced in default of treatment must be taken into account. From a large number of observations and experiments the writer concludes that low temperature control in Catalonia is fully justified and remunerative. It would be much more so if the vine-growers were to form an association and create a special organisation for this purpose, with a system of well placed watch Stations.

3 - Some Practical Means of Control of Wheat "Stretta", in the South of Italy. — MANGINI CAMILLO in *Il Coltivatore*, 62nd Year, No. 17, pp. 523-528. Casal Monferrato, June 20, 1916.

Wheat growing, extensively practised in the South of Italy, is very much checked by the disease called "stretta" of the wheat. This is a sort of sudden stoppage of growth accompanied by an almost certain drying when the wheat is in ear, and followed by unusual acceleration towards maturity, though the grain is not yet entirely full. The culm yellows early, and this allowing afterwards spreads to the entire ear or a part only. The affected part remains half empty and gives a smaller yield, because at the same time the grains are atrophied, small and light. "Stretta" usually occurs between the end of May and the beginning of June. The principal cause which gives rise to it is drought, and insufficient fertility of the soil is another cause. "Stretta" is more frequent in years with a hot and dry spring, and is more serious in too compact or too light soils, which, for opposite reasons, suffer more from the drought. On the other hand, "stretta" does not occur in wheat sown on beans or lupin ploughed in as green manures, or on broken-up meadow, lucerne, clover or sainfoin land.

From personal observations and experiments carried out during 40 years as an agriculturist, the writer advises the following means as being very effective against "stretta" and within the reach of all : 1) Deep tillage of the soil at the right time : very dry soils when deeply tilled during the summer did not suffer with "stretta", while neighbouring soils tilled very superficially with the plough did not even yield an equivalent of the seed ; 2) thin sowing, both in rows and broadcast, accompanied by rational and sufficient manuring, so as to allow and induce tillering ; 3) cultivation work in autumn, winter and spring ; it is very useful to cultivate two or three times between the autumn and the beginning of spring.

4 - Studies on the Amylase in Healthy Potatoes and in Those Suffering from "Leaf Curl". — See No. 851 of this Bulletin.

5 - Diseases of Undetermined Origin in the Tomato, in Ontario. — HOWITT J. E. and STONE R. E., in *Phytopathology*, Vol. 6, No. 3, pp. 162-166. Baltimore, Md., 1916.

In 1914 and 1915, tomatoes grown under glass were attacked by a disease the origin of which is still unknown, in several parts of Ontario. In the leaves, between the principal ribs, clearly outlined angular spots of dark colour made their appearance, often combining and forming larger blotches. The infection involves not only the mesophyll but also the secondary ribs (more rarely the main ones) so that the bundles of vessels are coloured brown. The leaves attacked do not grow normally, and in time wither and fall.

The soft young leaves of the terminal branches are the first to be attacked, then the disease descends towards the base, where it also attacks the already grown leaves.

Here and there along the stems, without any specific localisation, oblong spots 1 to 3 cm. in length appear, only involving the most superficial tissue and rarely (in fact only in very severe cases) extending to the vascular bundles.

The diseased fruits exhibit hollow spots assuming different shapes round or oblong, angular, with a diameter of 1 to 8-10 mm. In most instances the affection does not go beyond the surface of the fruit, but at times it penetrates to the centre, following the septum. The disease parts do not colour and remain green and hard even during the ripening phase. When the disease is far advanced, the entire fruit remains discoloured and falls before it is ripe.

It was thought at first that the disease could be identified with the brown rot of the tomato, caused by *Bacillus Solanacearum* E. F. S., but closer examination did not disclose the presence of any specific pathogenic germ. Attempts at artificial inoculation with infected tissue were entirely negative. Some growers attribute the characteristic affection of the leaves and fruits to the use of hydrocyanic acid fumigations, with which *Aleurodes* is controlled, but test experiments carried out to prove this gave negative results.

Experiments on sterilised soil seem to suggest the existence of a relation between the origin of the disease and the soil, but considering the absence of any pathogenic germ, it must be assumed that the disease is due to some chemical or physical defect of the soil, the action of which is to a large extent mitigated by sterilisation.

926 - A New Infectious Mosaic Disease in the Cucumber, in America. — DOOLITTLE
S. P., in *Phytopathology*, Vol. VI, No. 2, pp. 145-147. Baltimore, Md., 1916.

Experiments and tests in connection with a new "mosaic disease" observed in the cucumber, carried out by the Author in a field at the Station of Hamilton (Michigan), during the period 1914-1915. The first symptom of the disease is the appearance of black and yellow dappled spots between which the still green tissue stands out in distinct projections. If the infection develops, signs of growth cease, while on the leaves likewise a mosaic may be seen to appear, with dark green and light green spots. In the course of time, the diseased leaves wither and fall. On the shoots attacked, imperfect buds develop with dappled foliage; the flowers are few and the number of fruits set is still fewer.

The result of the experiments may be summed up as follows: 1) although it has not yet been possible to isolate the specific pathogenic agent as the disease spreads very rapidly it obviously is a very virulent disease of highly infectious character; 2) if infected matter is inoculated into healthy cucumbers, the characteristic symptoms generally appear within a period of 18 to 20 days, while all the control plants remain healthy; experiments of this kind, with hypodermic injections of sap extracted from the diseased tissues, were carried out in several places in 1914 and 1915, always followed by a clearly positive result; 3) artificial infections are also obtained by tearing off the leaves of a healthy plant and touching the wound with the broken leaf-stalk of a diseased plant; 4) The fresh expressed juice of diseased plants as well as that from diseased fruits inoculated into a healthy cucumber plant, also produced the disease; 5) infected extract retains its virulence even if passed through the Berkefeld filter; 6) aphids contribute

gely to the spread and extension of the disease, as is evident from the experiments carried out with *Aphis gossypii* Glover ("melon aphid").

- Mosaic Disease in Cucumbers grown under Glass. — JAGGER J. C., in *Phytopathology*, Vol. 6, No. 2, pp. 148-151. Baltimore, Md., 1916.

The symptoms of the mosaic disease in plants grown under glass are identical with those found in plants growing in the field. With regard to the effects, on the other hand, they are much worse, which fact is no doubt explained by the lower degree of resistance of plants which have developed in an artificial and enclosed environment. A few days after the appearance of the first symptoms the branches wither and die, and sometimes the whole plant dries up. Tests of artificial infection have been made by inoculating varying quantities of sap taken from infected plants into the stalk of healthy cucumbers with a hypodermic syringe. The result was variably positive. *Aphis gossypii* Glover contributes largely to the spread of the disease, as was shown by numerous experiments carried out by the writer in the vicinity of Rochester, New York. The infected sap of diseased cucumbers inoculated into plants of *Cucurbita* brought about the onset of the disease. Furthermore the plants thus contaminated, in their turn transmitted material which produced the same disease in other healthy cucumber plants.

- Sour Scab of Citrus Plants in Florida. — GROSSENBACHER J. G., in *Phytopathology*, Vol. 6, No. 2, pp. 127-142. Fig. 4. Baltimore, Md., 1916.

The name of "sour scab" is applied to a disease of the leaves, branches and fruits of certain varieties of *Citrus* having a strongly acid sap in their actively growing portions.

Citrus Aurantium var. *amara* (sour orange), *C. medica* var. *Lemon* (lemon) and *C. medica* var. *genuina* (citron) are very susceptible to the disease, and the same applies to almost all the commercial varieties of *C. decumana* var. *Poncirus* (grapefruit), except perhaps "Triumph" which appears to be a resistant variety.

The most evident pathological symptoms are the distorted appearance of the leaves and the warty, misshapen fruits. Both on the leaves and on the diseased fruits, conical elevations with greyish brown tips are found. The parts of the leaf seem to grow faster than others, which causes the characteristic distortion. As the season advances, the warty protuberances stand out slightly and become scabby. Finally, if the weather keeps sufficiently hot and moist, *Cladosporium Citri* develops at the infected spots and produces an enormous quantity of brownish-black spores.

The severity of the attack varies greatly from year to year and often from tree to tree. Generally this disease is more frequent in the hot and moist seashore region than in the pine region, which is more inland and at a greater altitude, where plant growth is slower.

On the other hand, when the weather is cold and wet at the beginning of spring this disease appears even in groves in high-pine land, especially where there has been an excessive use of nitrogenous manure.

Good results may be obtained, however, by individual selection of very

late types which might be capable of displacing the phase of maximum ^{intensity}, that is to say, the moment when growth is most rapid and most intense, to a point far ahead in the season, so as to make this phase coincide with a more favourable weather period. The Marsh seedless variety would be well adapted for this purpose. The quality of the host on which *C. decumana* var. *Pomelo* has been grafted also influences the development of the disease. The disease is more frequent in plants grafted on the wild lemon tree than in those grafted on the bitter orange (*C. Aurantium* var. *amara*), which are not so early.

The injury caused every year by this disease to the crop of *C. decumana* var. *Pomelo* in Florida totals \$ 50,000, and still greater injury is reported at Cuba, Porto-Rico and the Pine islands.

It is obvious from the foregoing that humidity is one of the most important factors in the development of the disease. When the small leaves begin to open, during the phase of rapid growth of the leaf, numerous small drops of dew form on both surfaces of the leaf during the night, the quantity varying according to the relative humidity of the air. If the latter remain near the dew point, the droplets combine to form one continuous layer of water, which covers the underside of the leaf for several days at a time. If on the other hand the air becomes very dry, the water which has accumulated during the night evaporates during the early hours of the day.

The moisture of the air and the presence of a water film on the leaves form very favourable conditions for the development of the disease. What is the deduction to be made from these circumstances with respect to the origin of the disease?

It is a well known fact that the acidity of citrus fruits becomes more pronounced in proportion as the humidity of the atmosphere increases and the temperature is lowered. Therefore the question at once suggests itself whether there is not a relation of cause and effect between the development of the disease and excessive acidity due to the wet and cold weather.

Localities	Materials used	Number of trees Counted	Total Number of fruits	Healthy fruits		Scabby fruits Number
				Number	%	
Orlando	Bordeaux mixture . . .	5	1281	887	69 1/3	394 30 1/3
	No treatment	4	1262	6	1 1/2	1256 99 1/2
	Lime-Sulphur	9	2371	542	22 1/6	1829 77
Bradenton	Bordeaux mixture	2	628	587	93 1/2	41 6
	No treatment	4	597	88	14 1/2	509 85
	Lime-Sulphur	4	1024	527	51 1/2	497 48
	Soluble sulphur (poly-sulphide of sodium) . .	4	843	454	53 1/2	380 46 1/2

During their phase of maximum growth, those varieties of *Citrus* which are most subject to the disease emit a strong aroma suggestive of acid. Under normal conditions it is volatilised, but when the leaf is covered with a thin layer of water, it enters into solution and is concentrated to such an extent as to attack the most superficial tissue.

Furthermore, the presence of water on the leaves promotes the growth of the glands. When the latter grow to an excessive extent, their walls are thinned and they often break, the contents being emptied on to the leaves and the rind of the fruit. The edges of these glands afterwards grow to such an extent as to form a crater-shaped hollow, in which the remains of the epidermal cells are found. When on the other hand the growth of the leaf in area predominates, the original injury due to breaking of the gland extends, and exhibits the characteristics of the disease.

The writer has been unable to establish definitely the chemical composition of the glandular content of *C. decumana* var. *Pomelo*. Nevertheless, it is known that the main constituents of orange oil, such as limonene, anthranilic acid and anthranilate of methyl, when applied to the leaves or fruits by means of a sprayer cause serious injuries.

The excessive growth of the oil glands, the injuries due to their bursting, the emergence and accumulation of their contents on the leaves and on the fruits, all of them phenomena which are facilitated by wet weather and cold, appear to be clearly connected with the origin and development of the disease.

The opinion obtaining hitherto, according to which *Cladosporium Citri* was the specific pathogenic agent, cannot hold good in view of the negative results obtained by the writer during a lengthy series of experiments. On small plants disinfected with bichloride of mercury at a strength of 1 %, and growing under conditions precluding all possible infection, the disease developed, and on the other hand it was not found possible in any case to cause it by inoculating spores of *Cladosporium* into the tissues of healthy plants.

Various experiments in connection with the application of remedies were carried out in two localities: at Orlando and Bradentown. The results are summarised up in the appended table.

It is advised to apply Bordeaux mixture at the height of the flowering period, following it, after an interval of 8 or 10 days, with an application of lime-sulphur solution and, three weeks later, with a second treatment, again with lime sulphur solution.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

2. Contributions to the Study of the Mycology of Liguria, Italy. — MAFFEI LUIGI in *Atti del R. Istituto botanico dell'Università di Pavia*, IIInd Series, Vol. XVI, pp. 223-243. Pl. XVII. Milan, 1916.

GENERALITIES

In this fourth contribution to the study of Ligurian mycology, the writer gives a systematic list of 141 species of fungi of which 85 are recorded for the first time in Liguria.

Among the species determined and studied by the writer, there are included some already recorded by others during the last few years, and which have been mentioned here in order to facilitate future research into Ligurian mycology.

In addition to the descriptions already recorded (1), the writer figures four species new to science.

The species: *Anthostomella Molleriana* Tray. and *Spessa* living on the leaf-stalks of *Phoenix canariensis*; *Ascochyta Spiraeae* Kab. and Bub., on the leaves of *Spiraea* sp.; *Myxosporium Balmoreanum* Speg. on the rachis of withered leaves of *Kentia* sp.; *Alternaria Dianthi* Stev. et Hall, on *Dianthus*, and some others again are new to Liguria and also to the Italian mycological flora.

The Writer makes critical observations in reference to several species: *Macrophoma calaritana* (Br. et Cav.) Maffei, living on the leaves of *Ceratonia Siliquea*; *M. Dracaenae-fragnantis* Mori, on the leaves of *Dracaena indivisa* etc.

To the bibliography previously given, 17 other works are now added.

930 - *Phomopsis diploglottidis*, *Ph. briosii*, *Coniothyrium hypoglossi* and *Ceuthospora pollacci*, new Micromycetes discovered in Italy.
— MUTTO ELISA, in *Atti del R. Istituto botanico dell'Università di Pavia*, IIInd Serie, Vol. XVI, pp. 205-207. Pl. XV. Milan, 1916.

A description of the following new species of micromycetes discovered in the Botanical Garden of the Royal University of Pavia:

- 1) *Phomopsis diploglottidis* n. sp., causing the appearance of spots at the tip and on the edges of the leaves of *Diploglottis Cunninghamii*;
- 2) *Ph. Briosii* n. sp., the presence of which produces the formation of spots which encroach on the leaves and leaf-stalks of *Roupalia nitida*;
- 3) *Coniothyrium Hypoglossi* n. sp., which causes spots on the cladode of *Ruscus Hypoglossum*;
- 4) *Ceuthospora Pollacci* n. sp. which grew on a stem of *Chamaedora elegans*.

931 - Diseases and Enemies of *Diospyros virginiana* in the United States. — See No. 872 in this Bulletin.

932 - The Part played by Insects in the Spread of *Bacillus amylovorus* — STEWART V. B. and LEONARD M. D., in *Physopathology*, Vol. 6, No. 2, pp. 152-158. Baltimore, Md., 1916.

Experiments with a view to ascertaining whether sucking insects are capable of spreading and inoculating into healthy plants the *Bacillus amylovorus* (Burr.) Trev., with which they may easily become infested when settling on diseased trees.

In the course of these experiments young pear and apple plants were used, enclosed in wire gauze cages. There was spread in abundance on some of these plants (2 or 3 per cage) a culture of *B. amylovorus* in agar. Afterwards, some specimens of the following insects were introduced into each

(1) See *B.* June 1916, No. 701.

age; *Pollenia rudis* Fabricius; *Empoasca mali* Le Baron; *Psylla pyricola* Förster; *Plagiognathus politus* Uhler and *Sapromyza bispina* Loew.

Although the insects were entirely at liberty to go from one plant to the other, the disease was unable in any case to spread from the infected to the healthy plants. This is probably due to the fact that sucking insects are not able to produce lesions of the tissues such as would facilitate penetration of the *Bacillus*.

There are insects which are much more active in this direction, although very few in number; they are: false tarnished plant bug (*Lygus invitus* ay) and the apple red bugs (*Heterocordylus malinus* Reuter and *Lygidea tenuata* Reuter). The possibility of the bacilli penetrating into the plant through the lesions caused by these insects cannot be dismissed.

3 - On the Susceptibility of *Phaseolus vulgaris* and *P. multiflorus* to Bean Rust (*Uromyces appendiculatus*) and other Fungoid Diseases. — LAKON GEORG, in Zeitschrift für Pflanzenkrankheiten, Vol. 26, No. 2, pp. 83-97, Stuttgart, 1916.

Mycological literature indicates no specific differences between *Phaseolus vulgaris* and *Phaseolus multiflorus* as regards their susceptibility to bean rust. The experiments of the present writer however show that such specific differences do exist. He studied several kinds of beans belonging to these two species, which are grown in his garden, where rust was very prevalent the year before. The plants affected were: 3 varieties of *P. multiflorus*, 3 climbing varieties of *P. vulgaris* and one variety of *P. vulgaris nanus*; they are so near to each other that the possibility of infection was the same for all the plants.

At the end of the summer when the fungus appeared in consequence of the intense formation of teleutospores, a difference was observed in the susceptibility of the different plants. It was noted that the plants were either strongly attacked by the parasite or else free from fungi. This phenomenon was first of all put down to characteristics inherent in the varieties. More thorough studies showed indeed that *P. vulgaris* was alone attacked, while *P. multiflorus* was quite free. The difference was so great that later on it was possible to distinguish one species from the other merely by the presence or absence of the parasite; these results were also confirmed by subsequent botanical examination.

These observations were completed with the aid of more abundant material. A large number of kitchen-garden plants at Hohenheim and vicinity were first of all studied, and it was found that *Phaseolus multiflorus* was exempt, while *P. vulgaris* was always strongly attacked. Attention was next given to a large number of varieties of beans grown in the Botanical Garden of Hohenheim, namely: 7 different kinds of *P. multiflorus*; 37 different varieties of the climbing form of *P. vulgaris* and 24 different kinds of *P. vulgaris nanus*. A minute study of each of the leaves of all these specimens disclosed the following facts:

1) all the specimens of climbing forms of *P. vulgaris* were strongly attacked and covered with teleutospores of the fungus;

2) Among the 24 varieties of *P. vulgaris nanus*, 8 had all specimens strongly attacked and 13 had all their individuals free;

3) All the individuals of the 7 kinds of *P. multiflorus* studied were exempt, with the exception of 2 belonging to 2 different kinds, in which the Author was each time able to find a single leaf slightly attacked.

Therefore these results confirm those obtained in the preceding researches, and it is concluded consequently that *P. multiflorus* is practically resistant to bean rust. Cases nevertheless occur where this species is likewise attacked by *Uromyces*, but they are so rare as to be without importance in practical phytopathology.

These experiments proved that there are differences in regard to rust-resistant powers not only between *P. vulgaris* and *P. multiflorus*, but also between the different varieties of *P. vulgaris*. Consequently the resistance of the different kinds should be determined by cultivation experiments continued over several years. In the literature unfortunately little information is given on this point.

It was not possible to determine the cause of the immunity of *P. multiflorus*. It is well known that rust appears most frequently at the end of summer, that is, at a time when the plant is already partly exhausted. It was concluded from this fact, that resistance to rust is connected with the time at which the exhaustion of the plant takes place. This hypothesis appeared particularly plausible when it was considered that *P. multiflorus* lives longer than *P. vulgaris*. Closer examination however demonstrated that this assumption is without foundation. It was shown that plants of *P. vulgaris* which, owing to their very late plantation, were still in full vigour and provided with young fresh foliage at the end of summer, already contracted rust at this stage of development. Nevertheless, this question should be still further studied by experiments in which the time of exhaustion is accelerated by artificial means.

Phaseolus multiflorus not only resists rust better than *P. vulgaris* but is also more resistant to other diseases, above all bean anthracnose which appears on the pods and is caused by *Gloeosporium Lindemuthianum* Sac. and Magn. *P. multiflorus* therefore represents a species highly resistant to certain fungal diseases. It therefore deserves to be more extensively grown the more so as the seed it produces is very good.

934 - The Selection of Types of Tobacco Resistant to *Thielavia basicola*, in America.—JOHNSON JAMES, in *Phytopathology*, Vol. 6, No. 2, pp. 167-181. Fig. 6. Baltimore, Md., 1915.

Root rot in tobacco is caused by the fungus *Thielavia basicola* Zopf, which attacks the roots only. Affected plants are characteristically stunted and thus the yield is considerably reduced. Complete destruction of the plant is rare.

The disease remained unknown for a long time, and to the present day escapes notice in many cases, because the symptoms accompanying (retarded growth, yellowing of the lower leaves) are in the majority of cases attributed to the advancement of the season or the unfavourable chemical physical properties of the soil.

All kinds of tobacco are not equally liable to contract the disease (see Table page 1201).

Varieties	Green weight of 25 plants		Relative resistance per cent
	in uninfected soil	in infected soil	
	lbs	lbs	
White Burley*	66.5	3.0	4.5
Comstock Spanish*	59.5	20.0	33.6
Connecticut Havana*	45.0	20.75	46.1
Kentucky Greenleaf*	49.75	3.0	6.0
Pennsylvania Broadleaf*	82.5	14.0	16.9
Brasil Beneventano*	56.0	41.25	73.0
Maryland Broadleaf*	65.0	2.5	3.8
Talia Kentucky*	60.0	39.5	65.8
Cig Oronoco*	57.75	3.0	5.2
Ohio Seedleaf*	70.5	15.25	21.6
Yellow Pryor*	59.0	2.5	4.2
Black Seedleaf*	84.25	23.25	27.6
Ballard Havana*	58.5	33.25	56.8
Gregory's White Burley*	59.75	1.75	2.9
Little Dutch*	79.50	40.0	50.3
Montgomery Seedleaf*	93.50	44.0	47.0
Maryland Narrowleaf*	16.50	2.25	3.3
Span*	28.25	5.25	18.5
Northern Hybrid*	15.0	45.5	70.0
Golden Spanish*	50.0	25.5	51.0
Silver Leaf*	56.25	31.5	56.0
Hage's Comstock*	41.25	32.5	78.7
Fee Seed*	49.0	37.25	76.0

An examination of the table shows clearly that the degree of resistance varies considerably from one type to the other, but unfortunately the most resistant types are also the least used and least appreciated, while the varieties most sought after, "White Burley", "Comstock Spanish" and "Connecticut Havana" are extensively injured by the fungus. In the present article there are set out the results of a series of researches and experiments undertaken with the object of selection from among the best varieties susceptible to the disease the small number of individuals offering some resistance, and which might serve as the basis for a renewal of the seeds.

After having explored a considerable area of plantations, at the Agricultural test Station of Madison, Wisconsin, and at Walker Son's Farms, Walkerville, Ontario, Canada, there were isolated 45 plants of the type "White Burley" and 42 cigar leaf types ("Comstock Spanish", etc.) They

are clearly distinguished from the others by their high degree of resistance to the attacks of *Thielavia basicola*. These plants were covered with hoods to ensure self-pollination; they were numbered and noted, and the seeds of each of them were sown separately on special plots.

Type "White Burley". — The experiments relating to this were undertaken at Ontario. On the plantations of "White Burley," "mongrels" or "Green Burley" specimens are sometimes met with, which are distinguished by the decided green colour of their leaf-stalks and ribs, which, on the other hand, are whitish in colour in normal plants. The green plants resist the disease better than the others. Some of them being isolated and reproduced in pure lines, were found to be resistant and true to type, while others split up into green and white. It was possible to isolate from the latter, resistant types such as "B 1193", the resistance of which in infected soil may exceed one hundred times that of the common "Burley" (relative resistance 42.6 and 0.5 respectively) and "P 701 B" which is not yet fixed, but already promises well.

"Cigar Binder Leaf" Type. — The experiments in relation to this were conducted at Madison. The best types "Comstock Spanish" and "Connecticut Havana" are going more and more out of favour with planters and are replaced by types resistant to *Thielavia*, such as Seedleaf", "Big Seed", "Hybrid" (as representatives of these latter types see table: "Page's Comstock", "Pease Seed" and "Northern Hybrid" which nevertheless give a product somewhat inferior in quality).

In the plantations of Wisconsin, as already stated, 45 specimens were isolated, the progeny of which were studied and tested during the period 1913-1915. The data collected cannot be used for instituting comparisons, because the infected soil was so fertile that it yielded a crop in excess of that of the sterilised soil. They at any rate show the possibility of obtaining by individual selection, superior types having at the same time a high degree of resistance.

935 - Resistance of *Pyrus calleryana* to Necrosis of the Bark and Branches (*Bacillus a mylovorus*). — See No. 879 in this Bulletin.

936 - Studies on the Resistance of *Prunus* spp. to *Bacterium tumefaciens*. — SMITH O. CLAYTON., in *Phytopathology*, Vol. 6, No. 2, pp. 186-194, Pl. VI. Baltimore Md., 1916.

Experiments were undertaken with a view to studying the degree of resistance to *Bacterium tumefaciens* in the different species and varieties of fruit trees of the genus *Prunus*. This bacterium is, as was proved by the researches of ERWIN F. SMITH, the primary cause of the hypertrophied formations on the branches and twigs, which are known under the name of "crown gall" (1).

All the species of *Prunus* are not equally liable to contract this disease and it must not be considered impossible to find and fix practically immune types which might serve as a basis for a progressive renewal of the orchard

(1) See *B.* Feb. 1913, No. 185.

(Ed.).

Species	Variety or origin	Number of inocu- lations	Infec- tions	% of infec- tions com- pared to inocula- tions	Size of galls mm
<i>pumila</i>	2 varieties	110	0	0	
<i>domestica</i>	« Italian prune »	140	10	7	1.5-3
<i>crassifera</i>	<i>P. plantericensis</i>	40	3	7 1/2	1.5-2
<i>domestica</i>	« German prune »	240	24	10	1.5-12
<i>insititia</i>	« Damson »	120	13	10	3-12.5
<i>Besseyi</i>		50	5	10	3-12.5
<i>hortulana</i>	« Golden Beauty »	110	25	22	1.5-3
<i>Amygdalus</i>	« Bitter Almond »	100	22	25	3-9
<i>domestica</i>	« Reine Claude »	90	25	26	1.5-12.5
<i>Armeniaca</i>	« Mikado »	40	11	27	1.5-4.5
<i>angustifolia</i>	<i>P. Watsoni</i>	50	15	30	1.5-3
<i>maritima</i>	« Arnold Arboretum »	140	48	34	1.5-3
<i>dasycarpa</i>	» "	130	55	42	1.5-12.5
<i>multis</i>	» "	60	32	53	1.5-3
<i>crassifera</i>	» "	110	70	63	1.5-6
<i>Munsoniana</i>	» "	70	48	68	3-4.5
<i>Munsoniana</i>	Arkansas	90	70	77	1.5-9
<i>americana</i>	« Arnold Arboretum »	100	83	83	1.5-12.5
<i>hortulana</i>	» "	130	108	83	3-18
<i>insititia</i>	<i>P. pendula</i>	90	77	85	1.5-18
<i>baccharia</i>		110	96	88	1.5-18
<i>triflora</i>	« Burbank »	120	109	90	12.5-37.5
<i>sigra</i>	« Arnold Arboretum »	60	56	90	6-9
<i>orthoscopala</i>	» "	80	72	90	1.5-3
<i>Mume</i>	» "	100	91	91	6-12.5
<i>Munsoniana</i>	« Pitt Arnold »	140	130	92	1.5-37.5
<i>crassifera</i>	<i>P. divaricata</i>	100	94	94	3-18
<i>Persica</i>	« Elberta »	130	122	94	6-18
<i>Armeniaca</i>	« Royal Apricot »	120	117	97	6-25
<i>infusa</i>	« Arnold Arboretum »	140	137	97	3-18
<i>Munsoniana</i>	El Paso	100	97	97	6-12.5
<i>crassifera</i>	(shoots and slips)	120	117	97	6-37.5
<i>infusa</i> X <i>P. Simonii</i>		140	138	98	1.5-18
<i>crassifera</i>	(one tree)	150	150	100	6-37.5
<i>monticola</i>	Experim. Stat. of Arizona	40	40	100	12.5-37.5
<i>Simonii</i>	« Arnold Arboretum »	130	130	100	6-37.5

which has now become necessary: 1) owing to the increasing spread of this disease and the extensive damage it occasions: 2) owing to the impossibility of detecting young plants with incipient disease before planting: 3) owing to the persistence of the germs in the soil, which germs later on attack the healthy plants.

The plan adopted in order to determine the degree of resistance to *Bacterium tumefaciens* is to inoculate pure cultures (in standard agar with the addition of 0.5 % of dextrose), at one week's interval, from May till September for the purpose of testing the plant in all phases of growth.

Three lots of bacteria were used: "No. 694" isolated from infected young peach plants; "No. 753" from the galls of an almond tree (14th April 1913); and "No. 790" isolated from an adult peach tree.

The species and varieties of *Prunus* examined were the following: *P. alleghaniensis*; *P. americana*; *P. Amygdalus*; *P. Andersoni*; *P. Armeniaca*; *P. Armeniaca* var. *Mikado*; *P. avium*; *P. Besseyi*; *P. caroliniana*; *P. cerasifera* var. *planteriensis*; different varieties and various types of *P. domestica*; *P. eriogyna*; *P. glandulosa*; *P. hortulana*; *P. ilicifolia*; *P. integrifolia*; *P. Mume*; *P. Munsoniana*; *P. nigra*; *P. orthosperma*; *P. pennsylvanica*; *P. Persica*; *P. platicarpa*; *P. pumila*; *P. serotina*; *P. Simonii* and *P. Watsoni*.

The various degrees of susceptibility are measured by means of the frequency of infestation and the size of the galls, which vary from 5 cm. in diameter to such small dimensions that it is difficult to distinguish them from the surrounding tissue.

In the appended table are found the data arranged in comparative form. For *P. ilicifolia*, *P. caroliniana* and *P. Amygdalus*, a complete series of observations are wanting. Nevertheless these experiments show that the first two species are highly resistant, almost immune. On the other hand, *P. amygdalus* is highly susceptible.

Of the resistant species therefore the best would be *P. pumila*, and the two varieties "Italian prune" and "German prune" of *P. domestica*. Nevertheless *P. pumila* is not adapted for re-stocking owing to its tendency to dwarf the varieties grafted on it. On the other hand, such good results were obtained with the two above varieties of *P. domestica* that it would be advisable to continue experiments in this direction, so as to isolate in the *domestica* group practically immune varieties or types, the possibility of existence of which must not be precluded. *P. hortulana* is considered by many fruit-growers as destined to yield good results specially in the indigenous varieties. The resistance to *Bact. tumefaciens*, is however not considerable, except in the variety "Golden Beauty". In the "Damson" group *P. institutia*, known under the name of *P. pendula*, is rather susceptible; the other kinds, on the contrary, present a high degree of resistance and are certainly capable of supplying good material for further work.

For the peach tree (*P. Persica*), conclusive data are not available. Nevertheless the varieties "Elberta", "Saucer" or "Peento", "Salway", "Lovell" and "Muir" seedlings hitherto examined, did not show resistance.

Fourteen kinds of almond trees (young plants growing at Davis, Cali-

mia, on the University Farm, were inoculated in 1916, and in all there is an abundant formation of galls. The same results were obtained with *Armeniaca*, *P. Armeniaca* var. *Mikado*, *P. Mume* and *P. mandschurica*. The major part of the varieties and kinds at present preferred in California as basal material for orchards are therefore, in principle, highly liable to contract crown gall; on the other hand, there are types, little known yet, belonging to different groups and especially to the species *P. domestica* which, if duly controlled and selected, may furnish an excellent renewal stock.

17 - Prophylaxis in Vegetable Pathology. — COMPS ORAZIO, in *Reale Istituto d'Incoraggiamento di Napoli*, 173 pp. Naples, 1916.

The writer points out that though it is still absolutely necessary to resort to therapeutic means whenever the plant is ailing or attacked by parasites, it would be desirable, on the other hand, to take into account what is long been practised in animal pathology. In animals, the extension of the action of hygiene limits the sphere of therapeutics in a greater degree day by day, and in the same way, by more rational attention and more appropriate measures, the cultivated plant must be made stronger, and more capable of resisting the attacks of its enemies; in other words, greater attention must be devoted to the hygiene of the plant.

Yet it must not be forgotten that sensitiveness to bad weather and receptivity to parasites vary in plants with age, methods of cultivation, and the environment in which they are grown. Furthermore, ordinary practice shows that the resistance to adverse agencies varies in cultivated plants with different races, and, in the same race, with the individual. It follows that the whole, the resistance is rather individual than specific. In view of the remarkable influence of the environment and methods of cultivation on the plant, it must be expected that this influence will be clearly reflected in the capacity of resistance of the plant, even if the latter be modified so as to render receptive plants considered as immune, and also to cause fungi considered as inoffensive or at least as semi-parasitic to become injurious.

On the other hand, from the biological point of view, it cannot be maintained that there are absolutely immune races; nevertheless, such steps may be taken as to ensure that their resistance to adverse factors should not be reduced so as to jeopardise their productivity. This object might be obtained by hygiene and prophylaxis. The latter alone could little by little lead to the abolition of the empirical methods which still predominate; guiding vegetable pathology once for all along a rational path, it will result in rendering intensive agriculture more economical, in spite of the ever-growing delicacy of its products.

Such is the theory maintained by the writer, and the object of his article. He reviews an extensive series of observations and researches collected from the literature on the subject.

His work is divided into two parts: in the first he deals with plant susceptibility to disease, and in the second with resistance.

As regards the susceptibility, the influence of the climate, soil, cultiva-

larvae concealed therein die on exposure to the sun on the dry soil; 2) graze sheep on the cultivated lands: many insects are crushed by the flock; 3) to spread here and there in the most infected places poisonous substance (for instance arsenic salts) kneaded with bran and molasses, which thesects eagerly devour.

952 - *Batrachedra rileyi*, a Microlepidopterous Pest of Maize in America.

HARNED R. W., in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 295-298, Fr. Concord, N. H., 1916.

During the last few years, the larvae of the small pink corn worm (*Batrachedra rileyi* Wals.) have caused much injury to maize, both in the field and warehouses, in almost all the counties of the State of Mississippi.

In 1914, the invasion was limited to the central part of the region (counties of Attala) from which, in 1915, it reached all the other counties, which caused the gravest anxiety to farmers.

The writer's observations during the entomological campaign which he undertook on that occasion may be summed up briefly as follows:

1) In the plantations affected, the number of infested ears varies from 10 to 99 % and the number of larvae per ear, according to ARNO figures averages $4 \frac{1}{2}$; 2) these larvae partly destroy the rachis and the grain of which they sometimes devour the whole interior, only leaving the external integument intact; or else they mine tunnels when going from grain to the other, and will even feed on the grains already injured and gnawed by other insects, often completing the destruction of such grain; 3) in warehouses, the larvae of *Batrachedra* generally infest the stored material from November to December, although they are often discovered in April; 4) plantations situated on hills generally suffer much more than those in the plain; 5) early varieties of maize contain less larvae than late ones; 6) the parasite usually attacks the tip of the ear, from which it croaches on the other grains and even the rachis; the frosts in January 1915 were fatal to a large number of the said larvae.

953 - Variegated Cutworm (*Peridroma margaritosa*), a Macrolepidopterous Pest of the Sugar-beet in California. — BENSEL G. E., in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 303-306. Concord, N. H., 1916.

The variegated cutworm (*Peridroma margaritosa* (sancia) Hübn.) has become very common in the country of Ventura, has during the last years been responsible for widespread havoc to sugar beet plantations, especially when the season was cold and foggy.

The larvae of the insect remain concealed during the day in the ground at a depth of 3 to 5 cm., and come out at night in search of their food. They sometimes attack the aerial parts of the beet, to the extent of entirely stripping them of their foliage. In some cases the attack extends to roots, which are more or less spoilt and gnawed.

Among the natural enemies of *Peridroma* there are two species of *Coccinella*: *C. semilaeve* Lev. and *C. cancellatum* Esch.

The following artificial means of control have been successfully applied: 1) the application of arsenical compounds by means of spray,

size of their tissues in consequence of the shortage of available nitrogenous substances in the compact soil, but also, and in a still greater degree, to the acidity of their cell juices, owing to the incomplete combustion of the carbohydrates chiefly contained in the roots, the air circulation being difficult and sometimes interrupted in compact and uncultivated soil.

Cultivation. — 1) By cultivation man has rendered edible the organs of wild plants which are to-day replaced by their cultivated varieties.

2) Assiduous, intense and even forced cultivation results in inducing an enlargement of the organs of the wild plant, and also renders them succulent in consequence of the increase of volume in the anatomic elements as compared with the cellular tissue, as well as by the continually greater diminution of their walls, until the elements of the sclerenchyma are seen almost to disappear.

3) By progress in the improvement of a plant, its sensitiveness to adverse causes is also increased.

4) The development of a parasitic infection is always related to the medium (environment in which it develops) which is offered by the tissues of the plants attacked ; the result is that, all other conditions being equal, the infection increases with the improvement gained by the plant.

5) Conversely, for fruit plants, seed reproduction habitually produces a retrogression in the improvement obtained ; the same retrogression is brought about by the absence of cultivation ; the products, which in both cases are marred in quality, certainly run less risk of disease than similar plants, but improved.

Nitrogenous Manure. — 1) Manuring with suitable manure renders the tissues more juicy and consequently more sensitive to bad weather ; they are also richer in sugar, and consequently more attractive to animal and vegetable parasites.

2) The richer a soil is in nitrogen, the shorter the period of time elapsing between inoculation and infection with a vegetable parasite ; there is also an increase in the receptivity of cultivated plants to parasites of every kind. An abundant nitrogenous manure, in whatever form given, always produces the same effects.

3) Nitrate of soda, which calls forth greater productivity of the plant, on the other hand renders it much more tender, and consequently more sensitive to the bad effects of adverse factors.

4) Excessive nitrogenous manure prolongs the growing period of plants and retards lignification ; consequently the foliage will be more sensitive to winter cold, with a loss in the new production and risk of loss of sap and gum.

In the 2nd part of the work on plant resistance to disease, the writer examines the following questions in succession : the resistance of the plant organs; the chemistry of the tissues; the acidity of the sap and oxydases; the acidity of the sap and plant parasites; the acidity of the sap and animal parasites; tannic substances and parasites; selection crossing and high grafting ; manures.

The conclusions are as follows :

Resistance of the Organs. — 1) The organs of wild plants have more compact, i. e. less watery, tissues, and more acid, i. e. less sweet, juice than the organs of the corresponding plants of cultivated species.

2) More resistance is offered : (a) to rusts, by the varieties of wheat with narrower and more waxy leaves (yellowish in colour), such as those in the hottest and driest regions ; (b) to smuts, by those varieties of wheat which are bearded, the loss of the beard being a sign of improvement ; (c) to lodging, by those varieties of wheat which, like the Noë, have the solid part of the culm more fully developed ; (d) to diseases, by those varieties of potato which have hardy and straight stalks, leaves small and downy, and the tubers covered with a coarse skin ; (e) to diseases, by those varieties of olive tree which have smaller olives and a less developed mesocarp together with a more compact wood : (f) to diseases, by citrus plants obtained by sowing rather than those obtained by non-sexual reproduction ; (g) to diseases in general, by those plants which present morphological characters similar to those of hot and dry regions, non-fatty xerophytic plants.

Chemiotaxy of the Tissues. — 1) Whilst the resistance is different in the different races or varieties of the same species bred under like conditions no characteristic anatomical difference was found in their tissues by which the different resistance to diseases could be explained.

2) Any variation in the environment or in the methods of cultivation produces a modification in the strength of resistance, so as to render susceptible even those races which had previously been regarded as refractory.

3) Both resistance and susceptibility are individual and inherent characters rather than race characters.

4) The substance endowed with positive chemotropism is formed in the sugars and starches, but more particularly by the former than by the latter.

Acidity of Sap and Oxydases. — 1) In a given organ, other conditions being equal, the receptivity to parasites increases with the quantity of reducing sugars ; and on the other hand, resistance increases with the organic acids.

2) In the cell sap the reducing sugars increase as the organic acids diminish and vice-versa.

3) Those organic acids which, during the night, serve to excite the zymotic processes calculated to promote the migration into the leaves the organic materials produced photosynthetically, are on the contrary transformed during the day, partly at least, into food substances, i.e. carbohydrates.

4) The organs (branches and fruits) which present a stronger resistance to the attacks of parasites are the youngest organs, above all when in the period of growth and more acid.

5) The organic acids help to provide growing organs with the turgidity which is necessary in order to promote the zymotic process which, by mobilising the stored materials, are to supply sufficient nourishment.

nt to the growing organs; they contribute to this by absorbing and re-
ming the water in circulation.

6) In alkaline soils, such as limestone soils, and those irrigated with
aline water, cultivated plants present a lesser quantity of free acid in
ir tissues and are more sensitive to adverse factors.

7) Oxydases are more abundant in the more juicy tissues and in
se diseased organs which are richest in nitrogenous substances; they are
st active in the hottest regions, where also the organic acids contained in
e plants burn up; this combustion produces CO_2 , which is eliminated, thus
iving the plant of the acidity required to render it resistant. For this
son, in hotter regions, other conditions being equal, the plant is more
sitive than in less hot regions. In proportion as the acidity of the juices in
e organs diminishes, their sweet taste will become more evident, and
e parasites will find them a more agreeable and more abundant food for
ir growth.

Acidity of Sap and Plant Parasites. — 1) Organic acids are poisonous
micromyctes.

2) The greater acidity of the sap produces a greater resistance in
ants as follows : (a) wheat to rusts; (b) wine stocks to oidium, mildew and
tuberculosis". (c) the olive to *Cycloconium* and *Stictis Panizzei*; (d) the
pink, potato and hyacinth to bacterial infection; (e) fruit plants in
eneral to root rot and gummosis.

3) Pruning, by rejuvenating the branches and foliage of fruit trees,
reases the resistance to adverse agencies.

Acidity of Sap and Animal Parasites. — 1) As the increase of the quant-
y of reducing sugars (very much sought after by insects) in an organ is
tended by a reduction in the organic acids and *vice versa*, it follows that
ility is the weapon most used by the plant against animal parasites likewise.
mong acids, however, the most poisonous appears to be malic acid.

2) The greater acidity of the vegetable juices presents a defence in
he following cases : (a) the young branches of the white mulberry from
Huspis pentagona; (b) the young citrus plants from *Pseudococcus citri*;
citrus plants from *Crysomphalus dictyospermi*; (d) improved young fig trees
nd those obtained from seed, from *Ceroplastes rusci*; (e) young olive trees
from *Saissetia oleae* and *Philippia oleae*; (f) ordinary and citrus fruits, from
attack by scale insects; (g) olive trees, from the "fly" (*Dacus oleae*);
(h) the grape, from *Albinia Wockiana*; (i) vines, from phylloxera.

Tannic Substances and Parasites. — 1) Tannins, which are acid sub-
stances, behave like organic acids, and that is why they abound in growing
rgans, defending the latter against the attack of parasites, especially
egitable parasites.

2) In artificial nutrient media, the presence of tannin added in differ-
nt proportions prevents the germination of the spores or else it stops the
rowth of the mycelium. In this case, tannin clearly causes a more effective
antifungal action of the wall of the cell itself.

3) Anthocyanine, as a substance derived from bodies (tannins) en-
closed with a relatively high osmotic power, contributed, like tannic sub-

stances, to increasing the resistance of plant organs against their parasites. For this reason, the varieties or races of fruits or grapes which are intense colour, from red to violet and bluish, are always more resistant in comparison with varieties of the same species with more or less pale fruits.

4) The tanins co-operate with the other organic acids in defending the organs of the plants even against their animal parasites ; hence the pure hybrid American races of vines, richer in tannic acid, are always more resistant to phylloxera, other conditions being equal.

Selection, Crossing and High Grafting. -- 1) The resistance to adverse factors varies in the same environment, just as to the variety and the race of one and the same cultivated species. This resistance being inherited, is essential to maintain it by renewed selection, the value of which is almost exclusively local.

2) Resistance is greater in the varieties usually held in least esteem; in this case, when selection seems insufficient, it is indispensable to resort to hybridisation, especially for grasses, and to a high grafting on hardy stock for fruit plants, unless reproduction by seed is resorted to.

3) With similar processes there have also been produced resistant races : (a) of wheat to rust, smut and lodging ; (b) of buckwheat, sugar beet and stone fruit Rosaceae, to heavy frosts ; (c) of asparagus to rust ; (d) of tomatoes, cotton tree and water melons, to wilt ; (e) of potato, to mildew ; (f) of strawberries, to mould ; (g) of vines, to oidium, mildew and phylloxera ; (h) of citrus plants, to gummosis and root rot.

Manuring. -- 1) Potassium, lime, iron and magnesium must be applied to the plants in the form of sulphate exclusively ; the separation of the corresponding ions, which is done by the roots, would set at liberty the sulphuric acid, which, even in a very small quantity, would, by recombination increase the acidity of the juice circulating in the organs of the plants and render resistance stronger.

2) Nitrate of soda is the nitrogenous manure which, more than another, tends to reduce the acidity of the organs and render them more sensitive to enemy action ; sulphate of ammonia, on the contrary, causes a production which is somewhat less in quantity but renders the plants more resistant because it tends to increase the acidity of their organs ; in alkaline soils, the use of nitrate of soda will, by accumulating sodium, result in diminishing the original fertility and will produce progressive sterility.

3) An excess of nitrogenous manure, especially in the nitric form causes an increase in the formation of starchy products which, like sugar, render the organs more susceptible to parasites. On the contrary, phosphate manure produces a transformation of the soluble nitrogenous substances (or starchy substances) into insoluble nitrogenous substances (or phosphoproteins) which possess a negative chemotropism. This manure, while it accelerates the ripening of the fruit and lignification of the branches tends to protect them from the attacks of external agents and at the same time contributes to maintaining or increasing the acidity in the organs, thus strengthening them in their struggle against parasites.

4) In order as far as possible to ward off attacks on cultivated plants infested by physical agents and parasites, prophylaxis must be based on sulphatic manure, more or less assisted by an addition of sulphates.

- *Means of Control of Chrysophyctis endobiotica, a Potato Pest in Germany.* — SCHAFFNIT E. and Voss G., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, No. 3-4, pp. 183-192. Stuttgart, June 1, 1916.

I. — *Experiments in Soil Disinfection.* — The experiments were carried on fields over-run by the parasite, at Nederpleis, with a series of materials in different degrees of concentration. The disinfection of the soil was done between the 10th and 20th February, the plantation of the plots on the 25th April and the harvesting of the potatoes on the 29th October. Each plot had an area of about 7 sq. yds. The means of disinfection used were: "Beta-Lysol", sodium cyanide, chromium acid carbonate, "Flurasil", potassium cyanamide, sulphur and "Uspulun".

The kainite, calcium cyanamide and sulphur, as well as the mixtures of these materials, were first spread and then hoed in; the "Beta-Lysol", sodium cyanide, chromium acid carbonate, "Flurasil" and "Uspulun" were used in aqueous solutions. "Uspulun" is a preparation of mercury soluble in water; "Flurasil" is a compound of silica, fluorine and zinc. Both products are prepared in Germany. Each experiment was repeated three times on plots situated at different points.

The results of the experiments, which are summed up in a table, show that none of the agents gives satisfaction in every respect. The best effect was obtained with chromium acid carbonate, which, on the plots treated, gave 1.5% of diseased tubers, and 11.59% of stalks and leaves infested. Next came the plots which received a mixture of kainite and a large quantity of calcium cyanamide with 7.65% of tubers attacked and 21.37% of diseased stalks. The third place is occupied by plots which received sulphur or "Flurasil"; the first of these had 10.14% of diseased tubers and 31.81% of parts attacked, and the second 8.64% of diseased tubers and 33.63% of stalks and leaves attacked. The other means of control "Uspulun" (in large doses), sodium cyanide and kainite produced no effect.

If the soil is not uniformly and equally reached throughout its parts, experiments rarely give a good result. Owing to this fact, the tubers in certain plots treated were more infected than those of the check plots. This year it is hoped that the drawback in question has been avoided by a more uniform distribution of the plots over the soil at the time of autumn tillage. To sum up, it may be stated that the disinfection of the soil appears to be successful in some respects, and for this reason the writers will repeat the experiments for several years.

II. — *Behaviour of the different varieties of Potato towards the disease.* — 60 varieties were tested. Each plot had an area of about 4.5 sq. yds. The potatoes were planted from the 25th April to the 30th May, and harvested from the 6th to the 30th October following.

The results showed that the following varieties remained immune from the disease: "Jubelkartoffel", "Pulsens Juli", "Rote Delikatess-Niere", "Leingold", "Roma", "Blaue Rheinische Rauhschale", "Verbesser-

ter Tannenzapfen", "Vater Rhein" and "Wohlgeschmack". Part of the varieties were slightly attacked and part strongly (more than 50% of the tubers). The soil of the plots was no doubt less infected by the parasite than that of the plots used for the disinfection tests. This year, the experiments will be repeated on a larger scale with those kinds which were found immune in 1915.

III. — *Vitality of the dormant spores of the fungus in the soil when the host is not cultivated thereon.* — Previous observations have shown that the dormant spores of *Chrysophlyctis endobiotica* Schilb. retain their germination capacity in the soil for 6 years. By way of checking this observation the Writers acquired from the town of Kronenberg a field which was greatly over-run by the parasite, and which for that reason had not been cultivated from the end of the 1907 growing period till the spring of 1915. Two plots of the field were ploughed, situate at two separate points, and in the 1st April 1915 they were planted with the "Industrie" potato variety. On gathering the crop, a very strong infection was found on both plots. It clearly follows from this that the dormant spores may retain their vitality in the soil for 7 years. This year other plots in the field will be planted with potatoes, and the operation will be repeated subsequently in order to determine the time the dormant spores retain their vitality.

For practical agricultural purposes, it follows from these experiments that fields invaded by the parasite should not be put down to potatoes before the expiry of a period of 7-8 years, and it is even probable that the vitality of the parasite lasts still longer.

DISEASES
OF
VARIOUS
CROPS

939 - *Phytophthora* sp. Injurious to Oats in America. -- MC MURPHY JAMES I.
Science, New Series, Vol. XLIII, No. IV, p. 534. Lancaster, Pa., 1916.

Specimens of oats attacked by an unidentified species of *Phytophthora* were discovered in the vicinity of the University of Stanford and near Mayfield in California. Symptoms of the disease: spots and stripes of different sizes along the edges, or a long stripe running along the central line of the leaf. The parts attacked are first yellow, then whitish (when conidia are abundant); finally they become brown, dry and break up.

The conidiophores, which are short and simple, emerge through the opening of the stomata and generally carry a single conidium. Chlamydospores and oospores were likewise found in abundance on the infested parts.

In regard to these characters, this *Phytophthora* approximates to *P. Colocasiae* a parasite of "taro" (*Colocasia esculenta*), in Java, India and Formosa.

940 - Potato Diseases in the Dutch East Indies. -- WESTERDIJK J., in *Tijdschrift* XVIIth Year, 1st and 2^d Parts, pp. 1-15, I Pl. Batavia, 1916.

The Writer was able, during his stay in the Dutch East Indies, to study the cultivation of potatoes in Java, where it is carried on in the mountains, at an altitude of 1300 to 6500 feet.

While the few European growers devote all the necessary care to the cultivation, the natives use seed potatoes, too small in size to be of any value.

or consumption, for this purpose. In addition, they are sown too close in the potato fields, and the soil is insufficiently tilled and manured. They grow a variety of mediocre quality, but which is somewhat resistant to disease.

A description is given of the enemies observed on the potato. *Epilachna errita* largely destroys the foliage by gnawing it. *Phytophthora infestans* has been found in some plantations lying at an altitude of 5500 to 6500 feet; the climatic conditions hardly appear favourable for a spread of this disease in regions of a lesser altitude. *Macrosporium solani* causes a dry rot of the foliage, and has been found at an altitude below 5500 feet. A root fungus, the attacks of which are somewhat dangerous to other crops, sometimes assails potatoes. A disease, the cause of which is still unknown and which is shown by the leaves rolling up, is rather frequent in some newly imported varieties. Finally, considerable damage is caused by the disease known in Germany as "Eisenfleckigkeit". The diseased tubers do not differ externally in any way from the healthy ones. On cutting them open, brown spots are seen in the central tissues. These spots turn black when the potatoes are cooked. It has not been possible to find any very definite cause giving rise to this disease. Probably defects in the methods of cultivation, especially with the natives, very much influence its appearance, and an improvement will be observable when the usual methods are replaced by more rational ones.

Cronartium ribicola attacking *Ribes*, in Ontario.—HOWITT F. E. and MC CREEBIN W. A., in *Phytopathology*, Vol. 6, No. 2, pp. 182-185. Baltimore, Md., 1916.

In 1914 and 1915, in nine counties on the banks of the great Ontario lake, plantations of *Ribes* especially *R. nigrum* L. were considerably damaged by *Cronartium ribicola* Fisch. de Waldh.

The following cultivated and wild species were attacked: *R. nigrum*, *R. vulgare* Lam.; *R. grossularia* L.; *R. aureum* Pursh; *R. cynosbati* L.; *R. triste* Ball.; *R. floridum* L'Hér.; and *R. prostratum* L'Hér.

The aecidial form (*Peridermium*) is found on *Pinus strobus*, both native and imported, in the countries of Brant, Durham, Halton, Welland, Wellington and Wentworth.

In the spring, the infection spreads from the pine to the *Ribes* on which the teleutospore develops. It is, however, not impossible, although the experiments undertaken by the Writer yielded a negative result, that the disease may winter on the leaves of *Ribes* itself. As regards the susceptibility of the different species, *R. nigrum* is said to be the most susceptible. On the other hand, *R. rubrum* is thought to be much less so (the variety "London red" is entirely refractory) as also is *R. grossularia*.

It should be noted that this disease, which may be said to have no economic importance in Europe, may occasion extensive havoc in Ontario, owing to almost complete defoliation. With regard to the means of control, good results are obtained by applications of Bordeaux mixture or soluble sulphides for fifteen days during the summer.

942 - *Sclerotinia libertiana*, injurious to *Forsythia viridissima*. — PEGLION
VITTORIO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th Series, Vol. XXV, 1st Half Year, Part 9, pp. 665-657. Rome, May 7, 1916.

As early as the spring of 1915 the Writer, in some specimens of *Forsythia viridissima* in the garden of the School of Agriculture of Bologna (Italy), observed a withering of the shoots after flowering. An anatomical study of the lesions disclosed a limited but very pronounced disorganisation of the bark, and the presence of small black isolated sclerotia, mostly placed at the point of intersection of the leaf stem on the twig. According to the writer, the fungus is *Sclerotinia Libertiana*. If fragments of bark tissue are sown in nutrient gelatine, or if the withered shoots are placed in a moist room, there follows within a very short time a vigorous growth of mycelium and the differentiation of many large sclerotia.

The origin of this infection is to be sought during the flowering of the host. The flowers attacked adhere strongly to the stalk. On making a longitudinal section of these flowers, they are seen to be the seat of an extensive mycelial infection. The mycelium of *Sclerotinia* starts from the stigma and, passing along the style, enters the ovary, from which, traversing the leaf-stalk, it spreads in the cortical zone of the twig.

What here takes place is a mummification perfectly analogous to that produced by several species of *Sclerotinia* of the sub-genus *Stromatinia* in the female organs of various Rosaceae, and which, as is well known, are caused by the germination of ascospores or conidia (*Monilia*) on the stigma, followed by the penetration of the mycelium into the ovary, and from the latter into the branches.

The infection takes place when the vitality of the flower is already on the decline, because the germinal tube of the ascospores of *ScL. Libertiana* cannot develop in healthy vegetable tissues in full vitality. The infection is probably due to ascospores carried by the wind. The ascospores can germinate as soon as they are expelled from the ascus. In the cases reported by the writer they came from a plot cultivated with Jerusalem artichokes, where *S. Libertiana* is endemic.

Thus *S. Libertiana*, the pathogenic position of which was known in the typical forms of infection arising from injuries to the host (the writer is of opinion that it is anormal case of "chancr" or "Sclerotia disease" in hemp), from lesions following upon cold (as is the case with the Sclerotia disease of beans), is found to possess other means of penetration into its host, characterised by a more and more reduced period of life in the saprophytic stage. Such is the special form of the Sclerotia disease in the bean, described by PETRI (*Rendiconti della R. Accademia dei Lincei*, Nov. 20, 1914), in which the saprophytic stage develops at the expense of fragments of petals adhering by chance to the growing shoots, and finally the pathological process now in question which arises on the flowers of *Forsythia* and causes considerable injury to the stem of the host.

3 - Trichoderma koenungi causing Root Rot of the Apple Tree, in Virginia.

— CRABILL C. H. in *Phytopathology*, Vol. 6, No. 2, pp. 159-161, Fig. 1, Baltimore, Md., 1916.

In Virginia, rotting of the roots of the apple tree occurs chiefly in the valley of Shenandoah and the district of Piedmont. It is responsible for very heavy damage, and nothing has up to now been done to control it. Trees from ten to fifteen years old are usually attacked. The pathological process is rapid and fatal. The first visible symptom of the disease is a stoppage of growth, followed by the partial falling of the leaves and the withering of the terminal buds. At the moment when these symptoms appear, the root system is already dead, the roots are cracked and fragile, and the tissues invaded by an abundant growth of mycelium. Infection begins in the deepest roots and progresses upwards.

The following facts have been ascertained: 1) the rot is more frequent in land cultivated for the first time, especially if it contains some decomposing vegetable residue such as tree stumps; it is rarer in localities already cultivated for some years; 2) the rot is equally widespread in all types of soil, both on steeply inclined slopes and in plains and depressions; 3) in orchards, several trees forming a group die at almost the same time, which is proof of the rapidity with which the disease spreads; 4) "York Imperial" is said to be the variety most liable to attack; next follow: "Stayman Winesap", "Ben Davis", "Yellow Newton" ("Albemarle Pippin") and "Arkansas" ("Black Twig").

The writer obtained many cultures from infected material of different origin, and in all cases obtained abundant growth and fructification of *Trichoderma koenungi* Oudemans.

Place of origin of infected material	Number of cultures	<i>Trichoderma</i>	<i>Hydnomyces</i>	Bacterial Infection	Sterile
Hicktown	14	14	—	—	—
Hicktown	10	1	7	—	2
Plains	10	6	—	—	4
Saint Valley	20	12	—	11	1
Greenville	24	16	—	5	3
Woodstock	16	14	—	2	—
Woodstock	16	9	—	5	2
Totals	116	72	7	23	12

Trichoderma may be regarded as the specific cause of root rot. Other fungi however may be associated with it, for instance *Hydnomyces* and a bacterial flora which is sometimes very abundant.

The growth of *Trichoderma* in starch agar, at ordinary temperatures, averages 1 cm. per 15 hours; hence the rapidity of the pathologic process, which may bring about the death of the tree within a few days. The parasite grows equally well in any medium provided the latter does not contain an excess of alkali.

Copper sulphate in a dose of 0.1% added to the agar stimulates the formation of spores. A soil rich in humus and well manured promotes the growth of the mycelium and the formation of the spores. The vegetative body of the fungus is found in all the elements of the xylem, from which it spreads into and between the cells. It cuts off light from them entirely and encroaches on and destroys the walls.

Its property of living quite easily as a saprophyte, and the large number of spores which the wind scatters with extreme facility, render this parasite one of the most dangerous to the orchard, and it is necessary to take prompt and energetic control measures.

WEEDS AND PARASITIC FLOWERING PLANTS.

944 - *Cryptostemma calendulaceum*, *Crepis capillaris*, *Leontodon hirtus* and *Carduus* spp., Weeds in New Zealand (1). — ATKINSON E. H. in *Journal of Agriculture*, Vol. XII, No. 1, pp. 32-39. Fig. 9; No. 3, pp. 175-187. Fig. 1 Wellington, 1916.

1. The Writer continues the description of the common weeds in New Zealand by describing *Cryptostemma calendulaceum* (capeweed), *Crepis capillaris* (hawkweed) and *Leontodon hirtus* (hawkbit).

The first of these Compositae is very common in the Northern island. It has likewise been reported in numerous localities in the Southern island where it tends to invade the pastures, choking and replacing the leguminous and grasses best adapted for cattle feeding.

The two other species also occur very widely, but they should be rather considered as useless than injurious.

2. Description of 6 species of *Carduus* growing more or less frequently New Zealand : *C. lanceolatus* (spear thistle); *C. nutans* (nodding thistle); *C. pycnocephalus* (winged thistle); *C. arvensis* (Californian thistle); *Marianus* (milk thistle) and *C. eriophorus* (woolly-headed thistle).

C. lanceolatus is certainly the species most widely distributed in the two islands. This species is the one which imparts its characteristic appearance to the meadow flora when vegetation grows after bush fires. *C. arvensis* is also very common. *C. pycnocephalus* is much rarer; in certain steep and bare parts it often forms the sole winter forage for sheep. *C. Marianus* abounds in several localities, but tends to disappear with the development of cultivation. *C. eriophorus* only occurs along the rivers and in the valleys of Wairarapa and Otaki. Finally, *C. nutans* has been reported in southern Canterbury and some localities of Otago.

(1) See *B.* March 1916, No. 363.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

¹⁵ - Contribution to the Life History and Anatomy of *Lyda hypotrophica* (= *Cephaleia abietis*) (1). — SCHEIDER FRANZ, in *Zeitschrift für angewandte Entomologie*, Vol. 3, No. 1, pp. 97-116. Berlin, March 1916.

Development of the eyes. — During an outbreak of *Lyda hypotrophica* in the course of the last few years in Swabia and Upper Franconia, the Author, at different periods of the year (October, March-May) studied large number of larvae. He first classified the larvae according to their colour and then counted them. He thus determined three groups of larvae clearly distinguished from each other.

The larvae of the first group, apart from the dark brown X on the forehead, had a head uniformly greenish brown or light brown in colour. Those of the second group are distinguished by an ill-defined dark brown spot on the cheeks. The larvae of the third group had an oval deep black spot just above the eyes (eye spot). The larvae of the last group might also exhibit a spot on the cheeks. The study made by the writer proved that the oval spots of the larvae in the third group are nothing else than the future eyes of the pupa and the adult.

The writer calls them "pupal eyes". They are found in all the larvae which undergo transformation into pupae in the following spring.

Wishing to study the question more fully the writer examined a number of larvae of the first two groups mentioned above from the point of view of the genital organs. He found that in larvae which in the spring had not yet got pupal eyes, the genital organs had not yet developed. On the other hand the larvae having "pupal eyes" all had well developed sexual organs in March and April.

At what time of the year do the pupal eyes appear? The larvae ready for pupation already possessed them in March; on those which were without these eyes and which were enclosed in a cage they were not seen to appear after that time, that is, after the end of March. In some cases (17 larvae out of 9000 larvae studied) the "pupal eyes" were already observed in October.

The writer concludes that the pupal eyes do not always form in autumn in the larvae which pupate in the following spring.

The larvae which already showed the pupal eyes in October had well developed genital organs, but the development was not so far advanced as in the larvae studied in March and April.

In practice, it is important to be able to ascertain as early as March, on the basis of the "pupal eyes", whether or not there will be a large number of adult insects in the spring.

Number of eggs. — The writer also studied the number of eggs which a female can lay; he found that the indications given on this subject by the literature (maximum of 25) are inaccurate.

¹⁵ See B. July 1916, No. 839.

These investigations, which are not yet terminated, appear however to have shown that this figure is too low. It is quite possible for a female to lay up to 100 eggs.

Development of the genital organs — The investigations carried out show that the larvae of *Lyda* ready for pupation already possess well developed sexual organs while in other insects, e.g. the lepidoptera, the ovaries are still little developed even in the last larval stage. The genital organs form during the summer and autumn, at the same time as the "pupal eyes", but the Author does not think that there is any relation between the formation of these two organs. The testicles develop more rapidly than the ovaries. A very detailed description is given of the genital organs and the formation of the eggs.

The freshly emerged female, after mating, lays in the first oviposition about 30 eggs; later on, when the weather is hot, it lays more. Oviposition is complete at the end of 7 days. If it is rapid and intense the adult dies after 8 days of life. The arrival at maturity and oviposition are closely related to the weather; hot weather promotes them, bad weather hinders them. If bad weather is sufficiently prolonged the females die before ovipositing, and the consequence frequently is a rapid diminution of the insects in the forest.

Colour of the larvae. — Generally green larvae and yellow larvae are distinguished, but there are also all kinds of shades between these two groups. Among the larvae studied in 1913, 88 % were green and 12 % yellow. The hypothesis that the green larva is male and the yellow female was not confirmed by the present investigations. The colour is not changed until the larva has pupated.

It is likewise not true that the yellow larvae are individuals covered with parasites. The difference in the colour results from the blood of the larvae.

Parasites. — *L. hypotrophica* appears to suffer little from parasites; no parasites are known to attack the eggs, pupae or adults. On the other hand the larva is attacked by some species of Ichneumonidae and Diptera, but not to a great degree.

The larva of Ichneumonidae found by the writer in the larva of *Lyda* in October and spring, were still very small: 3-4 mm. Later, in the month of March, they were 6 mm. On being placed in a hot room they developed more rapidly, and produced adults within a few weeks.

The larvae of Ichneumonidae completely absorb the larvae of *Lyda* so that after a time nothing remains but the empty skin. They afterwards leave their hosts in order to pupate.

The Tachinid larvae living in the larvae of *Lyda* are more developed than the Ichneumonid larvae. They were already completely developed in October and entirely filled out the *Lyda* larvae.

They would remain therein during the winter and would only pupate in the following spring, when the weather is warmer. Thus these parasites are only found in small number in the larvae of *Lyda*.

The larvae of Ichneumonidae and Tachinidae are only found in those

Lyda which have pupal eyes. From this it follows that these parasites have a single generation per year, and that they only attack the *Lyda* larvae still living on the tree.

Control. — Judging from the life history of *Lyda*, it seems that expensive control measures are not justifiable. The larvae almost always eat the needles of the previous year and very rarely those of the actual year. Consequently the developing buds are not attacked by them. The growth of the trees suffers from the influence of the larva, but not very much. It is consequently advisable to abstain from any control measures against this enemy. The writer recommends that greater importance should be attached to the other enemies of the spruce which accompany *Lyda*, such as: *Pisoides hercyniae*, *P. scabricollis*, *Ips typographus*, *Pityogenes chalcographus*, etc. The method of pasturing pigs in the forest in order to destroy the larvae of *Lyda* is hardly practicable.

936 - White Grubs (*Lachnosterne* spp.) in Wisconsin, United States of America.—SANDERS J. G. and FRACKER S. B. in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 253-261, Fig. 3. Concord, N. H., 1916.

The results are here set out of a series of researches and experiments on white grubs (*Lachnosterne* spp.) undertaken at Madison, Wisconsin, in 1914-1915.

In order to capture the insects, light traps were employed (Coleman gasoline lamps of 300 to 400 candle power) placed near the receptacles containing water to which paraffin had been added, into which the insects, attracted by the light, fall. In Wisconsin there are five Stations (Lancaster, Dodgeville, Baraboo, Madison and Ripon) each provided with eight lamps.

From May to June 1915 there were captured 1 036 400 specimens of *Lachnosterne* belonging to the following species: *L. fusca*, *L. rugosa*, *L. grandis*, *L. dubia*, *L. hirticula*, *L. gibbosa*, *L. ilicis*, *L. balia*, *L. tristis*, *L. nitida*, *L. implicita*, *L. marginalis*, *L. vehemens*, *L. nova*, *L. prunina*, *L. inversa* and *L. villifrons*. *L. fusca* certainly the most widely distributed species; *L. rugosa* was not reported at Lancaster but was very common in the other stations lying further north.

In the early morning, in the evening, and generally when the days are cold, the larvae are rarely active and do not feed. On the other hand they are very active and voracious during the hottest hours of the day. Migrations in a vertical direction commenced by the insects under the influence of temperature variations are never observed in the soil. The larvae generally remain at the same level near the surface of the soil from which they only shift to go in search of their food. The latter consists of root or parts of roots. If the larvae are brought into contact with freshly germinated young plants they attack and destroy the radicle without touching the stem. They refuse bran or sweetened dough.

A number of larvae were left for five and a half months in a vessel containing only soil, and no food was given them. At the end of the period of experiment, two larvae were still alive and active; they had fed only on the small amount of vegetable detritus contained in the soil. In view of this

vitality and resistance it is not possible to use control methods based on the starvation principle.

In some experiments carried out on land infested with the larvae of *Lachnostenia*, grasses were transplanted the roots of which had first been steeped in a solution of arsenite of soda; the mortality of the larvae amounted in four days to 22.2 %. Under the same conditions the use of arsenite of lead gives negative results. If roots of young maize plants are poisoned with corrosive sublimate, the mortality of the larvae reaches 50 %.

Excellent results are obtained by protecting the seeds by treatment with creosote ; this substance keeps the larvae off.

STANT
NTS.

947 - Resistance of Different Varieties of Wheat to *Mayetiola destructor* in America. — HASEMAN L., in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 291-294, Concord, N. H., 1916.

The destructive cecidomyiid "Hessian fly" (*Mayetiola destructor*, Say) has caused very extensive injury to wheat almost throughout the great Mississippi valley.

The opinion generally held by farmers is that all varieties of wheat are not equally susceptible to attack, and that some types remain practically immune.

In order to ascertain the truth of this opinion, and also to arrive eventually at a selection of highly resistant types, a series of experiments was undertaken on a very large number of wheat varieties. In these researches there were ascertained the percentage of infected plants, the relative number of larvae, etc.; analyses were also made of the composition of the plant organs and sap, and observations on the manner in which development takes place, in order to fix and establish possible correlations. In the present work there are set out the results of a first year of research. These results do not yet possess the value of definitive conclusions, but they are none the less interesting, as they confirm the fact that the various types behave variously as regards the attack of *Mayetiola destructor*.

3 varieties of wheat were used: "Fultz", "Fulcaster" and an indigenous type regarded as very resistant.

Sowing was carried out on the 24th October, 1914. On the 10th May, 1915 the following observations were made :

Varieties of Wheat	% of infected plants	Maximum number of larvae per plant	Average number of larvae per plant
" Fultz"	58	18	2.72
" Fulcaster"	66	8	1.46
Indigenous used as control.	54	12	1.7

As regards this experiment, "Fulcaster" presents marked tendencies to immunity if compared with "Fultz". Furthermore, the results also prove that an indigenous type believed to be highly resistant may in reality be as badly attacked as some selected types.

The following particulars of yields were also obtained :

Varieties of Wheat	Number of ears	Weight	Weight of 100 ears
			gr.
" Fulcaster"	371	334	90.30
" Fultz"	439	324	73.89
Indigenous control	367	273	74.38

According to the analyses hitherto carried out, a relation between the degree of immunity and the ash content appears to be outlined :

Varieties of Wheat	% of ash in young plants	% of ash in straw
" Fultz"	15.146	5.147
" Fulcaster"	15.379	1.598
Indigenous	14.796	4.751

The degree of infestation in the three varieties appears to vary in direct proportion to the ash content.

Aspidiotiphagus citrinus, Endoparasite on *Chrysomphalus dictyospermi* in Italy. -- MALENOTTI Ettore in *L'Agricoltura italiana*, Und Year (11th series), pp. 73-75. Pisa, May-June 1916.

MEANS
OF PREVENTION
AND CONTROL

While collecting *Coccidae* on plants cultivated under glass at Florence, writer observed a case of parasitism of *Aspidiotiphagus citrinus* (Craw.) w on *Chrysomphalus dictyospermi* (Morg.) Leon.

This endoparasite, which often hatches from *Aspidiotus hederae*. *A. ulae* and many other species of diaspids, had only been reported previously a parasite of *C. dictyospermi* in one single case, namely by H. E. HODGSS. at Cromwell, Connecticut, on hot-house palms.

The degree of parasitism of *Chrysomphalus* by *A. citrinus* was very st. Of 121 females observed on two leaves, there were 21 which had d naturally, 97 parasitised, and 3 free. On other leaves of the same plant e coccids were likewise parasitised in large proportions.

The observations made now allow of establishing clearly the differences tween the behaviour of *A. citrinus* as compared with *A. lounshuryi* Berl. d Paoli on the same host. These differences are due in part to the dimensions of the adults of the two parasites which are markedly smaller in the case *A. lounshuryi*, and in part again by the different pathological action they exercise on their victims.

Chrysomphalus dictyospermi, so strongly attacked by *A. citrinus*, gathered by the Author on leaves of *Sanscieria arborescens* imported om the Natural History Museum of Paris. The species originates from apical Africa and the East Indies.

The writer was unable to ascertain whether *C. dictyospermi*, which, according to the supervising staff, has always been seen on *Sanscieria*, sought its parasite with it, or whether the latter arises from the Italian om which adapted itself to the imported coccid. In the hot houses of Florence examined by the writer *Chrysomphalus* is not found on citrus

plants. On the other hand specimens were gathered on *Cymbidium Trajanum*, *Aralia Reginae*, *Kentia* sp. and *Arenga* sp., but in small quantity as also attacked by the same endoparasite.

No such effective parasitism takes place on the citrus plants in cultivation infested by the "bianca-rossa" (*Chrys. dictyospermi*). The case observed by the writer might therefore be explained by the mild temperature and tranquillity which are peculiar to the environments constituted by glass houses, and in the fact that this polyphagous (or, more accurately, polyxenous) insect was compelled for several successive generations during the year to lay its eggs on the same diaspisid, which relatively, was not numerous.

949 - An undetermined Nematode Worm Parasite on Aphids. — DAVIS J. JOHN, *Psyche*, Vol. XXIII, No. 2, pp. 39-40, Fig. 1. Boston, Mass., 1916.

The writer has discovered an as yet undetermined nematode in the interior of the body of some aphids (*Anoecia* sp.) living at a slight depth in the roots of *Muhlenbergia* in the environs of Lafayette, Indiana.

This is a very rare case of parasitism. In 1899, DEL GUERCIO also described a nematode as a parasite and natural enemy of *Erama radicis* Koenenbach. Other cases of this kind had not been reported since.

950 - Nicotine Products tried in Germany against "Cochylis" and "Eudemis." KOIZEL in *Landwirtschaftliche Zeitschrift für die Rheinprovinz*, 17th Year, No. 18, pp. 265. Bonn, May 5, 1916.

In the spring and autumn of 1915, in two vineyards containing 24 stocks, at Bullay a.d. Mosel, the writer carried out experiments of control of "Cochylis" and "Eudemis," with the following nicotine substance: 1) "Nikotin Florkus Pulver" of the brothers Nördlinger, at Flörshain; 2) "Queria-Heu-und Sauerwurmpulver" of Otto Hinsberg, at Nackenheim a. Rh.; 3) tobacco juice containing 9-10% of nicotine, with the addition of a 1% solution of cotton oil soap.

The nicotine powders considered to be most effective against "Cochylis" were applied under strong pressure, on the 1st June, when the larvae had attained a length of 2-3 mm. The directions for use of the products question state that at that time alone it is possible to obtain the best result with the powders.

The tobacco juice was dissolved in water (1.5 gallons to 100 gallons of water), then applied on different bunches on the 2nd June, immediately after oviposition.

The result of the treatment was observable as early as the end of July in counting the coccids on the different branches. A vineyard 5 years old which was divided into 3 plots, contained on 40 stocks, the following numbers of larvae per plot.

Plot 1: treated with nicotine solution	—	148 larvae
" 2: " " Queria " powder	—	270 "
" 3: " " Nikotin-Florkus " powder	—	138 "

In an old vineyard there were counted, for 40 stocks the following number of larvae:

ifornia, on the University Farm, were inoculated in 1916, and in all there was an abundant formation of galls. The same results were obtained with *P. Armeniaca*, *P. Armeniaca* var. *Mikado*, *P. Mume* and *P. mandschurica*.

The major part of the varieties and kinds at present preferred in California as basal material for orchards are therefore, in principle, highly liable to contract crown gall; on the other hand, there are types, little known as yet, belonging to different groups and especially to the species *P. domestica* which, if duly controlled and selected, may furnish an excellent renewal stock.

137 - **Prophylaxis in Vegetable Pathology.**— COMES ORAZIO, in *Reale Istituto d'Inoculamento di Napoli*, 173 pp. Naples, 1916.

The writer points out that though it is still absolutely necessary to resort to therapeutic means whenever the plant is ailing or attacked by parasites, it would be desirable, on the other hand, to take into account what has long been practised in animal pathology. In animals, the extension of the action of hygiene limits the sphere of therapeutics in a greater degree day by day, and in the same way, by more rational attention and more appropriate measures, the cultivated plant must be made stronger, and more capable of resisting the attacks of its enemies; in other words, greater attention must be devoted to the hygiene of the plant.

Yet it must not be forgotten that sensitiveness to bad weather and receptivity to parasites vary in plants with age, methods of cultivation, and the environment in which they are grown. Furthermore, ordinary practice shows that the resistance to adverse agencies varies in cultivated plants with the different races, and, in the same race, with the individual. It follows that on the whole, the resistance is rather individual than specific. In view also of the remarkable influence of the environment and methods of cultivation on the plant, it must be expected that this influence will be clearly reflected in the capacity of resistance of the plant, even if the latter be modified so as to render receptive plants considered as immune, and also to cause fungi considered as inoffensive or at least as semi-parasitic to become injurious.

On the other hand, from the biological point of view, it cannot be maintained that there are absolutely immune races; nevertheless, such steps may be taken as to ensure that their resistance to adverse factors should not be reduced so as to jeopardise their productivity. This object might be obtained by hygiene and prophylaxis. The latter alone could little by little lead to the abolition of the empirical methods which still predominate; by guiding vegetable pathology once for all along a rational path, it will result in rendering intensive agriculture more economical, in spite of the ever-growing delicacy of its products.

Such is the theory maintained by the writer, and the object of his article. He reviews an extensive series of observations and researches collected from the literature on the subject.

His work is divided into two parts; in the first he deals with plant susceptibility to disease, and in the second with resistance.

As regards the susceptibility, the influence of the climate, soil, cultiva-

larvae concealed therein die on exposure to the sun on the dry soil; 2) to graze sheep on the cultivated lands: many insects are crushed by the flocks; 3) to spread here and there in the most infected places poisonous substances (for instance arsenic salts) kneaded with bran and molasses, which the insects eagerly devour.

952 - *Batrachedra rileyi*, a Microlepidopterous Pest of Maize in America. — HARNED R. W., in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 295-298, Fig. 2, Concord, N. H., 1916.

During the last few years, the larvae of the small pink corn worm (*Batrachedra rileyi* Wals.) have caused much injury to maize, both in the fields and warehouses, in almost all the counties of the State of Mississippi.

In 1914, the invasion was limited to the central part of the region (county of Attala) from which, in 1915, it reached all the other counties, which caused the gravest anxiety to farmers.

The writer's observations during the entomological campaign which he undertook on that occasion may be summed up briefly as follows:

1) In the plantations affected, the number of infested ears varies from 10 to 99 % and the number of larvae per ear, according to ARNOLD'S figures averages $4 \frac{4}{5}$; 2) these larvae partly destroy the rachis and the grains, of which they sometimes devour the whole interior, only leaving the thin external integument intact; or else they mine tunnels when going from one grain to the other, and will even feed on the grains already injured and gnawed by other insects, often completing the destruction of such grains; 3) in warehouses, the larvae of *Batrachedra* generally infest the stored material from November to December, although they are often discovered even in April; 4) plantations situated on hills generally suffer much more than those in the plain; 5) early varieties of maize contain less larvae than late ones; 6) the parasite usually attacks the tip of the ear, from which it encroaches on the other grains and even the rachis; the frosts in January 1915 were fatal to a large number of the said larvae.

953 - Variegated Cutworm (*Peridroma margaritosa*), a Macrolepidopterous Pest of the Sugar-beet in California. — BENSEL G. E., in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 303-306, Concord, N. H., 1916.

The variegated cutworm (*Peridroma margaritosa* (*sauvia*) Hübn.) which has become very common in the country of Ventura, has during the last few years been responsible for widespread havoc to sugar beet plantations, especially when the season was cold and foggy.

The larvae of the insect remain concealed during the day in the ground at a depth of 3 to 5 cm., and come out at night in search of their food. They sometimes attack the aerial parts of the beet to the extent of entirely stripping them of their foliage. In some cases the attack extends to the roots, which are more or less spoilt and gnawed.

Among the natural enemies of *Peridroma* there are two species of *Cabomba*: *C. semilaeve* Lev. and *C. cancellatum* Esch.

The following artificial means of control have been successfully applied: 1) the application of arsenical compounds by means of spraye

ted with a special 1 HP gasoline apparatus which serves to maintain a pressure of about 120 lbs during the operation; 2) applications of aceto-arsenate of copper in powder, applied in the morning when the leaves are still glistening with dew, which facilitates the adhesion of the preparation; the use of light traps (electric or acetylene lamps near which are placed receptacles containing water to which parafin has been added); in this way 600,000 adult insects were captured in a single season.

4 - *Epochra canadensis*, a Dipterous Pest of *Ribes* in America. -- WHITNEY L. A. in *Monthly Bulletin of State Commission of Horticulture*, Vol. V, No. 4, pp. 152-157, Fig. 52-55, Sacramento, Cal., 1916.

The yellow currant and gooseberry-fruit fly (*Epochra canadensis* Loew) uses great injury to *Ribes* spp. in numerous localities of the United States and Canada. The female, by means of its sharp-pointed ovipositor, lays eggs in the interior of the fruits, and the larvae emerging from them deface and spoil the fruits to a large extent.

As means of control, applications of arsenate of lead are advised at the time of appearance of the adults, according to the following formula: arsenate of lead, 4.9 lbs., molasses, 2.5 galls., water, 82.3 gals.

5 - Hickory Twig Girdler (*Oncideres cingulata*), a Coleopterous Pest of *Diospyros virginiana* ("Persimmon") in the United States. - See, No. 872 in this *Bulletin*.